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DISCOVERY

A Monthly Popular Journal of Knowledge

October 1937 — One Shilling

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ritish Association at Nottingham

By a Special Correspondent

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DISCOVERY

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Notes of the Month

Members of the British Association are to be congratulated on enjoying a pleasurable as well as profitable meeting at Nottingham last month. The convenience of having all the sections housed in one group of buildings (even the slightly detached Section L was only a few minutes' walk away) was a great boon; and the slight sinking feeling experienced by pedestrian members on the first day, when faced by the considerable uphill trudge from the main road to the University College buildings, was soon dispelled by the discovery of the special motor transport service from the City Square to the very doors of the University, which was organised by an efficient municipality and served by its extremely courteous and agreeable officials. One of the pleasantest features of the meeting, and one which met with the universal enthusiasm of members, was the unfailing kindness and helpfulness of Nottingham citizens of all sorts. Even scientists are human, and the desire for a warm welcome is the least blameworthy of human weaknesses. There was no doubt as to the warmth of the welcome provided on this occasion.

* * * *

The kindly demeanour of the men of Nottingham was ably seconded by the clemency of the weather. Seldom can the Association have been more favoured in this respect; the sun shone, but never fiercely, so that even those active members who rambled up and down the Derbyshire "edges" were not unduly afflicted by heat. Visits to works, also, were both entertaining and instructive, and a generous supply of efficient guides was accorded, enabling small parties to be formed so that all the visitors could hear and see everything necessary. Messrs. Boots were most liberal in the amount of time they accorded to the various sections and it is hard to say whether the detailed accuracy of the fine chemical works at Island Street or the stupendous efficiency of the model factory at Beeston excited the greater interest. Engineers and physicists expressed themselves delighted with their visits to the Rolls-Royce works at Derby—a model of machine-building organisation—and with the marvels of the Ericsson Telephone Works nearer home; and the courtesy of Messrs. Boots and Messrs. Chambers, the pencil manufacturers of Stapleford, in providing all members with a small memento, was greatly appreciated.

* * * *

As for the longer excursions, week-end and otherwise, the neighbourhood of Nottingham provided ample scope for all tastes; and if in one case a slight lack of pre-arrangement resulted in a dislocation of the time-table, the afternoon was so agreeable that members were prepared to tour the lanes of rustic Nottinghamshire almost indefinitely in the comfortable vehicle provided. One of the most interesting and informative trips was that provided by the courtesy of the River Trent Catchment Board, and even the stray member from another section who expected the steamer to take him to a cathedral was reconciled to his fate and took as keen an interest as the official party—an accidental proof of the value of co-operation between sections. Talking of cathedrals, the beauty and variety of the Cathedral of Southwell came as a surprise to those who were not already familiar with it; and the flower and leaf carvings of a 13th-century nature-lover were a source of unending delight. The descent of a pit or two in the Nottinghamshire coalfield was a new and inform-

ing experience to many members, and those of the teaching profession found much that was suggestive in their visits to some recent school buildings and to the near-by Borstal Institution.

* * * *

Another important meeting held last month was the fifth International Congress of Papyrology, inaugurated at Oxford under the presidency of Sir Frederic Kenyon, K.C.B., whose long tenure of the Directorship of the British Museum fitted him peculiarly well for the task. The earliest date in the history of papyrology, Sir Frederic pointed out, was 1778, when the first discovery of a papyrus to be recorded was made by some natives of the Fayum; not much interest was taken in these, and only one of the MS. written on papyrus survived, to be acquired by Cardinal Borgia and published in 1788. Subsequent progress was at first a mere trickle, and not until 1877 was a really large find of papyri made. The cardinal date in the modern science of papyrology, however, was 1891, when, among fragments of many other Greek authors, the lost treatise of Aristotle on the Constitution of Athens, found the previous year, was published by British Museum. (The editor, it may be mentioned, was Sir Frederic himself.) Since then the flood of new discoveries was kept up with the awakened public interest; the word "papyrology" appeared in the Oxford Dictionary of 1898; and our knowledge of the ancient literature of both Egypt and Greece has been vastly increased. A considerable quantity of old scientific texts has been recovered, throwing great light on the early history of science, especially perhaps of medical science. The possibility of important new discoveries is large, and the study of papyri presents a fruitful field for the labour of young scholars.

* * * *

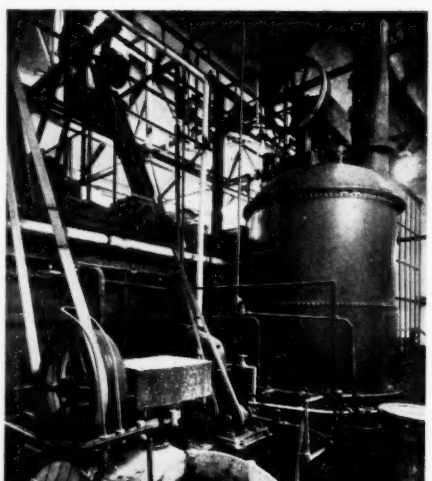
The B.B.C. announce two series of evening talks which should be of interest to all those concerned with science and education. The aim of the first series (National, Fridays, at 9.20 p.m.), entitled, "What more do you want?" will be to show the intimate relation between the work of the scientist and the lives of every one of us. It will not be a question of speculating about far-off possibilities, but on things out of reach to-day, which, to-morrow, may be put into our grasp with quite incalculable results: such problems as that of lighting, the chances of a prolongation of life, or whether we can go on increasing speed. Sir Henry Tizard will introduce the talks on October 15th. In the Northern programme is included a series of fortnightly talks on "Child Psychology," beginning on October 6th at 9.45 p.m.

* * * *

Rapid progress is being made, writes the Pretoria correspondent of *The Times*, with the building of the new Radcliffe Observatory, which, after 160 years at Oxford, is to have its future home in South Africa, near Pretoria. The administrative block, the library, and the residence for the director and his two assistants are all nearing completion, and the telescope house is likewise almost ready. The first casting for the "great" mirror of the telescope, which is to measure 74 in. in diameter, the largest diameter of any telescope in the Southern Hemisphere, has failed. The second casting, it is hoped, will prove successful.

* * * *

According to a prominent London daily, a new horror, and a somewhat unexpected one, threatens the unfortunate Spaniards of the Republic army. General Kleber, in the Republican trenches, according to a statement quoted from the German *émigré* Prince Hubertus Loewenstein, author, received a report of a new German-made weapon used by the opposing troops. This "is a kind of shell with a specially prepared termite filling fired by normal anti-tank guns. These shells, exploding inside the tank, develop 4,000 centigrades, melting steel and iron like snow." The ravages of termites on wood, and on cellulose generally, are well known to readers of DISCOVERY. It will come as a surprise to many that their powers have been combined (by some completely new scientific process) with those of high temperatures to cause iron and steel to disintegrate. The export of termites from Africa for shell-filling purposes would bring a welcome addition to the revenue of that continent. Or has the princely author, as quoted, mislaid an aspirate?



At Messrs. Boots' factory, Island Street, Nottingham. The plant for the manufacture of crude chloroform gives an idea of the huge quantities of material dealt with.

The Art of Lithography

By Miles Hadfield.

Lithography is an art as well as a commercial process and here the author describes the means by which small editions of artistic lithographic work are produced.

LITHOGRAPHY as an art, that is, as used by those who claim to be artists rather than skilled operatives, has had a short but eventful history. Prosperous during its first few decades, it met with a sudden and unexpected decline. However, rescued and revived in the eighteen-eighties, it has since survived, rather more modestly than formerly, though yet with considerable distinction. At the moment, to distinguish it from purely commercial lithography, the name autolithography is sometimes used. The process was first worked at Munich in 1798. So far as is known, the story of its invention has not yet suffered from the modern desire for disillusionment. Aloys Senefelder, an unsuccessful playwright, was trying to invent a cheap metal-plate process to engrave and print his plays. He was bothered by the necessity of writing in reverse, and to practise this he used slabs of the Kelheim stone employed for floors, because it was cheap and polished easily. One day he jotted down a laundry bill on a piece of this stone, using his varnish. Later, instead of polishing it off, he decided to see what would happen if he etched the stone in the manner of a copper plate. From this experiment, after many practical and financial difficulties had been overcome, was developed lithography. The process so evolved was quite different from anything Senefelder had in mind when he started, for it relied not on engraved or relieved lines to hold the ink, but on a chemical combination on a perfectly flat surface of stone. It was later found that metal such as zinc or aluminium would serve the same purpose as stone, and because plates of these are so much less cumbersome, they have succeeded it for commercial work. Lithography is, therefore a misnomer, though attempts to replace it by planography have not found favour.

An exercise in lithographic technique. After the design had been traced on a grained stone, the date in the upper left-hand corner was stopped-out in gum, and tone lightly rubbed over it with a piece of wash-leather covered with ink. The rest of the chalk drawing (to be printed in black) followed, the light lines in the foliage being taken out with a scraper. Next, the small square in the lower right-hand corner was polished smooth, and the lettering added, in ink, with a brush. This stone was then brought to a printing state, and an offset—a print made in a non-greasy powdered chalk—transferred to a second and polished stone. On this, the parts to be printed underneath the black (in yellow ink) were inked-in by brush and stippling.

The register marks, by means of which the black stone is accurately printed on the yellow print, are seen above and below the drawing.

Senefelder also found that a drawing made on special paper could be transferred to to the stone and printed from it—so overcoming his early difficulties with reverse writing. The process was first used for commercial work alone, particularly music printing. It is said that Napoleon's officers introduced it to fashionable Paris as a plaything for the dilettante. Soon passing to England, it was here also taken up by enthusiastic amateurs (there was even an amateur lithographic press worked by English residents in Behar!). From these patrons, serious artists came to know of the process, and men such as Goya and David began making prints.

In 1820 appeared the first of Baron Taylor's volumes, *Voyages Pittoresques et Romantiques dans l'Ancienne France*. It was extravagantly illustrated by lithography, and was typical of the albums and portfolios through which

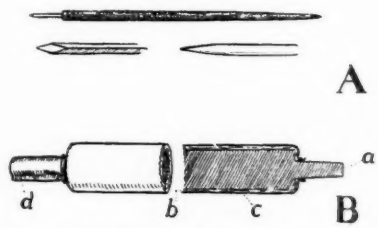
artists then reached their public—the modern exhibition of prints being unknown. The leading French artists—even Ingres—contributed plates, and such Englishmen as Bonington, J. D. Harding, and T. S. Boys. England and France were, during this early period, the homes of the artist's lithograph; although we cannot claim the great talent of the French artists of those days none the less early English lithography has fine qualities. There was a pleasant interchange of artists between the two countries, Géricault and others producing some of their best work here. They were specially influenced by our lithographed sporting and popular prints—an influence that has had some effect on later French art.

In 1830 *La Caricature*, an early periodical to use lithographic illustrations, was launched on its stormy career by Charles Philipon. It and its successors introduced the fine and fierce work, mostly of a political and satirical nature, of Gavarni (H. G. S. Chevalier) and Daumier to a wide public. These two men were virtuosi of the lithograph during what was, perhaps, its greatest period. Then, in the late 1840's, the talent which had been drawn to lithography, with a few exceptions disappeared, leaving it in purely commercial hands concerned mostly with technical improvements. The German copyists of old masters, and such prints as those of Adolf Menzel, reached an overbearing state of completion and finish.

The Revival of Artistry

The revival began in Paris during the 1880's. One or two printers broke away from the trade, which had become secretive and prejudiced against artists, and worked with men such as Fantin Latour. Later, both Impressionists and Post-impressionists made lithographs. The birth of the modern poster designed by artists, usually attributed to Jules Chéret, was an influence in this revival, for such posters are usually lithographic. Whistler, with the printer Way, followed by a pioneer group which included Shannon, Ernest Jackson, Hartrick, and Spenser Pryse, rehabilitated the art in England, where the Senefelder Club was formed to unite those interested in forwarding the process—which purpose it still performs. Joseph Pennell, the American illustrator, was another earnest advocate. There are now a number of fine lithographers in the U.S.A., where, if such prints as those of Currer and Ives are excepted, the process was entirely commercial until very recenly.

To-day, lithography is very catholic in its appeal to artists. As evidence of this one quotes at random such varied work as that of Brangwyn, Picasso, Augustus John, Matisse, John Copley, Moreau, Blampied, Edy Legrand, Paul Nash, Biddle, and Freedman.



A. Scraper in wooden handle and two typical scraper points.
B. Inking roller. The turned wooden core (a) *is covered with felt* (b), *and a leather covering* (c) *bound tightly round all. A leather sleeve* (d) *is slipped over each handle, so that the roller may turn freely in the operator's hands.*

Chalk and Ink.—In A, the action of a piece of chalk moved from left to right with increasing pressure over a grained stone, is shown. At first the grease is caught only on the raised pinnacles of the grain; as pressure is increased, the depressions are filled also. The result is a line shading from grey (i.e., broken by white spaces) to black (where the grease almost covers the stone).

In B, ink is used on a polished stone. However much is applied, once the surface of the stone is covered, an even tone is bound to result.

Three principles underlie the process. First, that grease (applied in the form of ink or chalk with which the drawing is made) enters into combination with limestone and certain metals. Where the grease has touched the stone this combination is formed, as indestructible as the surface of the stone itself. It is this combination, formed on the stone, that will later take the printing ink and form the printing surface. It should be understood that it is this, and not the visible ink or chalk used in making the drawing, that makes the print.

The second principle concerns that part of the stone on which no drawing has been made, and which, therefore, must not pick up ink. It is that when gum arabic solution is washed over the stone and allowed to dry, the arabic acid in the gum forms, on those parts free of

grease, a second combination with the stone—this time one that prohibits any further interaction between grease and stone. In other words, it may be said to fix the design on the stone, in a manner comparable with the fixing of a photographic plate by desensitisation, the activating agent being grease with the stone, and light with the plate.

The third principle involved, the mutual repulsion of grease and water, is employed in printing from the stone so prepared. There are now two surfaces on the stone. One, the design, formed of a grease-stone compound which is in effect greasy and so will repel water; the other, a clear, stone-gum compound, into which no grease will sink but which will absorb water. If, therefore, the stone is kept damp and a greasy printing ink rolled over it, this ink will adhere to the greasy surface covered by the design but will be repelled by the wet area on which there is no drawing, which will remain clean. It only remains to place paper in contact with the stone and pass both through a press to make a print.

That, in bare outline, is the theory of lithography. It will be realised that there are many more factors concerned than in a process relying on relief or intaglio engraving—and so much more to go wrong. It is therefore usual, but not universal, for the artist to hand the stone over to a skilled printer to carry out the stages following the drawing, the two working throughout in collaboration.

Given this summary of the theory, the practice, from drawing to print, may be followed a little more closely. The artist may make his drawing on a stone—say two or three inches thick and about one foot by one and a half feet in area. The surface is ground to give a rough grained surface when chalk is used, or polished smooth if ink, from pen or brush, is the medium for making the design. Alternatively, he may use a metal plate. Though these have superseded stone in commercial work, for the artist's purposes stone is a little more easily worked, and is still often used. The processes used for both are very similar, and where stone is referred to below, unless otherwise stated it may be assumed that plate may be substituted.

The metal plate is finished with surfaces similar to those of the stone, and after being treated with an affinitising solution is drawn or painted on in the same way. When the drawing is made on transfer paper, the same chalk or ink is used, and the design transferred to a stone by the printer. Chalk draughtmanship should be bold; fumbling, overworked drawing clogs the pores of the stone and its faults become exaggerated in the print. When ink is used, it flows evenly over the stone, resulting in an absolutely flat tone however thickly it is applied. Scraping may be superimposed on ink and chalk work. A fine, sharp, steel tool removes the surface film, baring the clean stone. A white line on the print results. Much can be done by skilful scraping of a drawing, and it is virtually the only method of correction. Once the surface of the stone has been cut and so lowered, no additional

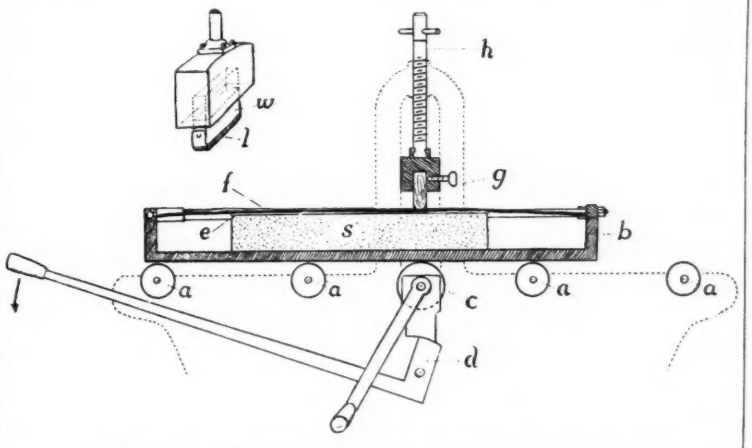


Diagram of a Lithographic Press. The movable bed of the press (b) *carrying the stone* (s) *is carried on free rollers* (a a a a). *It is moved under the scraper* (g) *by a roller* (c) *turned by a handle. This roller is mounted on a frame which is raised by a cam* (d), *rotated by depressing a long lever at the side of the press, which results in pressure being exerted on the paper and stone by the scraper. The paper and packing* (e) *are covered by the hinged tympan* (f). *The frame of the press is indicated by the dotted outline.*

In the drawing, printing pressure is just being applied as the front edge of the stone comes under the scraper (*which has been adjusted by the screw* (h)). *To fold back the tympan and remove the paper, etc., pressure must, of course, be released, and the bed of the press swung clear of the scraper.*

Inset is shown the wooden scraper (w) *with its leather-covered edge* (l) *held in an iron frame.*

chalk or ink applied to that spot will print—so again, the artist is warned against fumbling.

Some Favourite Devices

Stippling with a brush or pen, or with a pointed scraper; spattering with ink; the gentle rubbing-on of a tone with a piece of wash-leather; and stopping-out of parts of the design with gum before the drawing is made, are other techniques used which are essentially lithographic in their quality. Several are often combined on one stone. A favourite device in lithography is the printing of a flat tone (or tint) of very pale colour, into which high lights have been scraped or stopped out, under a drawing. This is often seen in old topographical prints. In modern posters it is developed by the use of several colours, flat or stippled, combined with a black or dark-coloured key drawing. There is also a process of wash drawing known as lithotint, but as a rule it cannot be called satisfactory.

The design finished, the stone is dusted over with chalk to congeal the surface grease and stop it spreading. It is then gummed. A slightly acid solution of gum arabic is gently dabbed over the surface, and the stone put on one side to allow it to dry thoroughly. Next, the drawing is usually washed-out—the superfluous ink or chalk and its contained colouring matter being dissolved in solvent, leaving only the true printing surface, on which the design is now almost invisible.

Rolling up follows. The stone is kept damp, and the ink roller passed over it and the design charged with ink, so that it reappears, to reinforce the greasy surface of the drawing and protect it during the next process, which is etching. This is not similar to the etching of a copper plate, the engraving done on the stone by acid is so negligible that it may be disregarded. What the acid does do is to clean up the clear parts of the stone and generally open up the work. The process relies on the skill of the operator, who may be able to improve a poorly executed drawing or damage a good one—according to his handling of it. Dilute nitric acid is generally used.

Hand and Power Press

For fine prints the hand press is still used. Alterations and adjustments can be made readily between each print, and, of course, a great number of impressions is not required. It should be mentioned, however, that any lithograph can be transferred to the metal plates used by modern power-operated presses with their large outputs.

The stone is placed on the bed of the printing-press (a metal plate is generally packed-up on an old stone) and kept moist by regular sponging. It is inked by a leather-covered (or sometimes composition-coated) roller, which has leather sleeves slipped over its handles, so that it rolls between the printer's palms. The printing ink is mixed and spread on a slab, usually an old stone, picked up by passing the roller to and fro over it, and then rolled evenly over the design. Next, the paper, usually damped, is placed on the stone, with another sheet or two of packing paper on top. A leather flap called the tympan, held in a frame which is hinged to the movable bed of the press (which carries the stone) is folded over all. The leather is kept lubricated and supple with a tallow dressing.

The bed of the press is next moved forward until the front edge of the stone (not the design itself) is brought under the leather-covered edge of a boxwood scraper, which is lowered by a screw until it bears on the stone—or more accurately, on the back of the printing paper through the intervening tympan and packing. Immediately below the scraper, and under the bed of the press, is the metal roller which moves this bed. Cams, worked by a long hand-lever, raise this roller, so that considerable pressure is exerted by the scraper on the stone. Under this pressure the bed is moved forward by turning the roller on which it rests. Passing under the scraper, the paper picks up the ink from the stone, and a print is made. Pressure is then released, the tympan swung back, the packing removed, and the print carefully peeled off the stone. The first two or three prints are usually weak, the stone not yet being fully inked. When any necessary scraping or alterations have been made, the remaining prints are taken in the same manner—the stone being kept damp, and re-inked for each print.

Register Marks

If further printings are to be superimposed on the paper, register marks are drawn on the stones just off the edge of the design. These the printer uses for placing the paper in exactly the right place on the stones used in subsequent printings—usually by drilling small holes on the marks on the stone, and picking them up by needles passed through the corresponding marks on the prints.

It should be emphasised that no more than a general outline of the process can be given in a short survey, for detailed practice varies from worker to worker—almost from print to print. But at the same time it should be said that lithography, given an understanding of the underlying principles, is in no way as formidable as these notes may make it appear. It is, in fact, a fascinating (and by no means overcrowded) medium for the artist who enjoys print making.

THE BRITISH ASSOCIATION AT NOTTINGHAM

Photo: Nottingham Evening Post

Our Special Correspondent reviews herewith in brief the contents of some outstanding papers read at this year's meeting of the British Association. The photograph above shows some members of the Association in the forecourt of the University watching the ascent of a sounding balloon sent up by Section A into the upper atmosphere.

THE impulse towards strengthening the connection between the work of scientists and the life of the nation was clearly evident at the meeting of the British Association this year. Each successive meeting nowadays tends more and more to dispel the impression that the Association is a thing apart, and there is a healthy growing interest on the part of the general public in what the Association is doing on their behalf.

Last year's presidential address dealt exhaustively with the social aspect of science, and this year the President, Sir EDWARD POULTON, by virtue of his long experience—at the age of 82 he can claim to be the senior of all Presidents that the Association has had—traced, in the history of past meetings, some of those currents that have brought the Association to its present status. He quoted a letter written by David Brewster a few months before the first meeting in 1831, in which the avowed aims of the new society were to be "to make the cultivators of science acquainted with each other" and "to bring the objects of science more before the public eye." Few will claim that these aims have not in great measure been attained. The text of the presidential address was the History of Evolutionary Thought, an aspect of science that was especially prominent during the years of the early development of the Association. The names of Huxley, Darwin, Wallace, Lister, Kelvin, and many more recent scientific giants illustrated the progress of the unravelling of the evolutionary problem, and the various main and side issues involved supplied the President with material for many amusing anecdotes.

Many of the most important steps in the development of evolutionary thought were made or discussed at past meetings of the Association: Weismann's conclusion that acquired characters were not hereditary; Ray Lankester's development of this towards the conclusion that educability is transmissible but not the results of education; and the recent development of the connection between small Mendelian variations and inheritance, following the work of J. B. S. Haldane, R. A. Fisher, and J. S. Huxley. The President continued with a summary of the position of Natural Selection to-day, a subject which was considered at an important meeting of the Royal Society last year. Here the work of the naturalist is of the utmost importance and recent studies in mimicry, warning and protective colouring, and the development of specially coloured subspecies, have thrown much light on the question, although doubt had

regrettably been cast on the value of these colour-variation data. A concluding word on the value of science in establishing and strengthening the conditions that made for international peace brought to a close an address which combined human, historic, and scientific interest in a notable degree.

In Section A (Mathematical and Physical Science) the programme this year was especially notable as showing a remarkable trend on the part of this usually austerely scientific group towards the application of their knowledge to everyday problems. The President of the Section, Dr. G. W. C. KAYE, accentuated the note of public utility by dealing in his address with one of the greatest and most obvious of everyday problems: noise. Throughout the history of the British Association no previous presidential address in Section A had dealt with acoustical matters, which proved indeed that "acoustics was long the Cinderella of the physical sciences." The development of the thermionic valve brought a change, however. The gramophone was followed by wireless, broadcasting and the talking pictures in succession; "and now acoustics, far from being a Cinderella, has become a radiant Princess of physics in whose career the public interest has become completely enchained. Her 'open sesame' revealed the interior of the Abbey last May to countless millions, who were vouchsafed a vivid acoustic imagery of the Coronation ceremony. For such technical miracles, no praise can be too high for the skilled army of technical and industrial workers who see to it that developments in invention, equipment and technique follow each other like a river in spate."

Evil of Needless Noise

Simultaneously with these developments there has developed a public consciousness of the insidious growth of the social evil of needless noise. With this growing realisation, the nation is beginning to demand and to receive protection against the nuisance of outrageous noise. It is looking for ways and means of mitigating excessive transport noises, and it is seeking to know why in modern houses or flats it should not be accorded adequate privacy against the noises of neighbours. At the same time it is to be noted that ordinary everyday noises, annoying though they be, are unlikely to impair hearing, though they may adversely affect efficiency.

Measurement of noise is a very recent development, and the arrival of the *phon* as a unit of measurement came in the nick of time to meet the present demand for noise abatement. The President described the work being done at the National Physical Laboratory and by the Ministry of Transport towards attaining this end, as there was no doubt that a solution of the problem was of material significance to every section of the community.

A further question of wide importance discussed in Section A was that of X-rays and Industry, to which a symposium was devoted, opened by Sir WILLIAM BRAGG. The advantage of the X-ray method of examining materials was that it proved the existence of regularity of molecular arrangement (*i.e.*, crystallinity), a matter of great importance since the properties of all materials depended ultimately on molecular arrangement. Dr. SHEARER spoke of the use of X-rays in the metal industries, as showing notably the effect of "cold working" on metals, their fibrous structure, and the orientation of their atoms, all of cardinal importance in metallurgy. Dr. BERNAL showed how the importance of physical methods in the food and chemical industries was growing, now that many of the materials dealt with were proteins and other substances of a composition too complicated for the methods of pure chemistry. He appealed for a closer connection between chemists and physicists, whereby each group could adapt their methods to fit in with the discoveries of the other group. The British Association, he suggested, was the body most fitted to work to this end, by supplying the connecting link between the two groups.

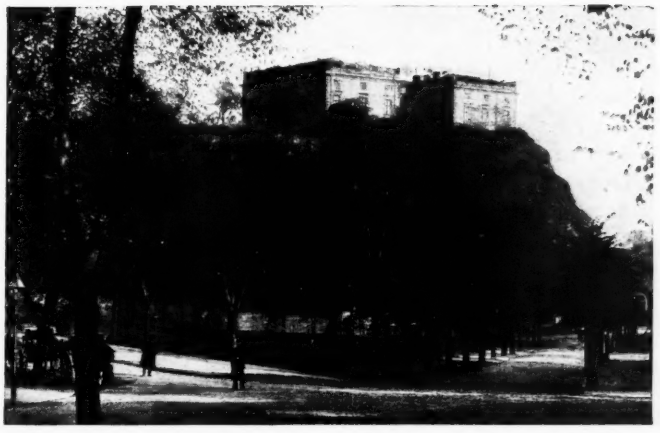
Evolution of New Drugs

In Section B (Chemistry), Dr. PYMAN'S presidential address on Chemotherapy dealt with the development of the treatment of disease by chemicals which have been shown by biological methods to be highly toxic towards the organisms of disease while relatively harmless to their human hosts, the development, in fact, of anti-sepsis. Several new bactericides and amœbicides had recently been studied, many of them by Dr. Coulthard in Messrs. Boots' laboratories at Nottingham, and great progress had been made towards the evolution of new drugs for the treatment of disease.

Sections C (Geology) and E (Geography) comprised a topical discussion on the potential mineral resources of Nottinghamshire and Lincolnshire. Water supply and building materials were dealt with by Professor SWINNERTON, while Mr. S. G. CLIFT described the progress of the Nottinghamshire "Concealed Coalfield." These coal-seams, which were first struck in 1859 at a depth of 1,500 feet, form an immense reserve of excellent house and industrial fuels. They show a pronounced easterly dip, subject to marked folds and faults, and there is room for their exploitation eastward toward Lincoln, where the overburden of newer rocks reaches 3,000 feet, the practical limit of mining under present-day conditions.

In Section D (Biology), the presidential address, by Professor F. A. E. CREW, was on "The Sex Ratio." The preponderance of the female numbers over the male in the human sex ratio begins after the age of 20 and increases with increasing age. There is nothing unique about this ratio and it may well be regarded as an indication of the relative lack of importance of the male in the respect of the propagation of the species. As Mr. MARSHALL and Dr. BAKER put it in a paper on the sex ratio of New Hebridean animals, the "significance for the species is simply to act as a dice-box for the production of new combinations of genes." An interesting symposium of this section and Section K (Botany), dealt with "Recent Work in Genetics and Cytology." Dame HELEN GWYNNE-VAUGHAN introduced the subject of reproductive incompatibility, showing how many plants with efficient sexual apparatus could fail to become fertilised without any mechanical prevention. Incompatibility occurred both in plants with male and female cells combined (self-incompatibility) and could extend beyond the individual to varieties or groups (cross-incompatibility). In higher plants fertilisation has been shown to depend on the presence of appropriate genes, and in all cases observation pointed to incompatibility as a means of securing exogamy and a high degree of hybridisation. Dr. SIRKS suggested that it was probably caused by something in the chemical nature of the genes concerned, possibly their osmotic properties. A further discussion, opened by Professor CREW, on the genetical aspect of crossing-over, was illustrated by Dr. C. D. DARLINGTON, whose demonstration (with strands of coloured wool) of the twisting and breaking of the chromosome threads claimed to show that crossing-over was an essential part of sexual reproduction, not merely a mechanism for providing new combinations of hereditary differences.

In Section G (Engineering) Sir ALEXANDER GIBB'S presidential address dealt with "Research in Engineering," a matter of vital importance to the whole community in our mechanical civilisation. Engineers have not always been too ready to use research, preferring the light of practical experience, but that attitude is now a thing of the past. A national plan, however, is still to come, and in the engineering world there are still two outstanding questions, the co-ordination of effort and the promotion of intensive research. A very suggestive paper in this section, by Mr. L. H. POMEROY, dealt with the design of motor vehicles in the interest of traffic safety. He dealt with the concentration necessary to avoid accidents on the part of the motorist, and the consequent desirability of features of design likely to reduce fatigue. In many ways the motor-vehicle designer was too much at the beck and call of the selling end of the organisation; the modern "streamline" body design, for example, has been evolved at the expense of the amenity of driver and passenger. Great advances had been made in the direction of silent operation, which tended to reduce driving fatigue. In the afternoon following this paper, the section paid a visit to the Rolls-Royce works at Derby; it may be said, with little fear of contradiction, that in these works efficient and safely-designed motor vehicles are turned out without any sacrifice of good appearance and apparently with satisfaction to the selling end of the business.



Nottingham Castle, the scene of the civic reception to members of the British Association.

The address of the President of Section H (Professor J. H. HUTTON) to the assembled anthropologists, dealt with the question of the origins of the Oceanic peoples and the remarkable affinities of culture between them and the Naga tribes of Assam. Throughout the Pacific Islands greater or less indications have been discovered recently, pointing to a migration from Farther India through Indonesia to the remoter islands; and, as Professor HADDON pointed out at a subsequent discussion, a similar movement had been directed westwards towards Madagascar. An important association lies in the relation between canoes and slit wood gongs, which Professor Haddon and Mr. J. HORNELL have lately been working out. A more domestic point in anthropology was brought out by Lady RAGLAN, in her paper on the "Green Man in Church Architecture." This curious figure, usually a more or less grotesque head surrounded by foliage, depicted in roof-bosses, beneath stall-seats, and in other often obscure sites, is to be associated with the Jack-in-the-Green—the leaf-

embowered figure once a regular feature in the end-of-May processions in English villages, a probable relic of ancient fertility rites. Local legend connected this figure with Robin Hood, and in the public mind there was a strong association with Charles II, who hid in an oak tree and (perhaps intentionally) arranged his Restoration Day to fall on May 29th. Professor S. H. HOOKE, in his paper, threw an interesting light on the story of Cain and Abel, which presents some very puzzling features, due to its linking up, by later editors of the Old Testament, with the Paradise legend. It would appear to represent a conflict between the pastoral and agricultural modes of life, and a similar story occurs in Egyptian and Babylonian myth. The fratricidal motive would appear to be not a necessary part of the legend, but became obviously essential when it was combined with the Paradise story.

Physiology and Education

A very important part of the programme of Section I (Physiology) was the discussion on "Physiology as a Subject of General Education." Professor WINIFRED CULLIS appealed for an approach through physiology, rather than through general biology, to instruction in the knowledge of the human body. Physiology, after all, is the science of health and normality, and its teaching would help to counteract the present-day tendency to focus on the abnormal. The normal is not news, and, therefore, Press support was lacking to the exponents of the teaching of such a subject. Yet the influence of an informed public on the health and well-being of the community would be enormous. As far as infant welfare went, we were well enough equipped, and the infant mortality rate was now only 57 per 1,000 (though that of New Zealand is 31 per 1,000); but after-development fell far short of that standard. Professor Cullis stated that all employers should have some knowledge of physiology, though her suggestion of compulsory examination in elementary physiology for all M.P.'s was perhaps not quite serious. Industrial psychologists were well aware of the close relationship between psychological and physiological problems, and this question opened up a fruitful field for further work.

Dr. H. MAGEE, following, substantiated the claim that the teaching of physiology fulfilled both the cultural and the utilitarian aims of education, though the practical end would always remain the principal part, since physiological knowledge led to the establishment of habits of healthy living. Examples of the misapplication of physiological knowledge were to be found in the present-day attitude towards sun-bathing, dieting, and violent exercise. Professor R. C. GARRY advocated the use of the human body as material for biological instruction, and Dr. L. P. LOCKHART accentuated the point that physiological knowledge was more than ever a necessity in large industrial communities. Industrial discontent should be treated physiologically and not politically. Those who administer national and industrial affairs need not be technical physiologists, but they need to be so educated that they can grasp the essentials of the technical evidence submitted to them. In the instructional work in secondary schools physiological knowledge should be introduced as a means of interpreting other subjects. There is a physiological basis to social change and evolution, the knowledge of which throws the strong light of living human interest on to history and commercial geography; but still more important is the function of physiological knowledge itself as the basis of sound health and sane morals. Professor D. BURNS, who had previously contributed a valuable introduction to the discussion on "Physiology and Health," gave some interesting facts relating to the excellent results of some voluntary physiological classes he had conducted among Glasgow boy scouts; a most remarkable result was a general improvement among them in all-round intelligence. At the same time he reinforced Professor Garry's warning against the "half-baked physiologist," who, in his ignorance, is too apt to recommend quack nostrums for the alleged improvement of health. Miss CAMPBELL, speaking from the teacher's point of view, stressed the difficulty of finding time to teach physiology adequately with the actual materials, and expressed a strong doubt, when referring to after-school welfare, whether employers possessed such a thing as physiological consciousness. Dr. PAGE, speaking also as a teacher, noted the value of sound physiological instruction as a counteragent to the sensational reports of abnormal physiology heard of and read of by children. The sense of the meeting lay definitely in the direction that the teaching of physiology was a good thing.

Anomalies of Botany Teaching

An educational subject was likewise chosen by Professor E. J. SALISBURY for his presidential address to Section K (Botany). An examination of the modern study of plants in relation to education reveals a rather anomalous state of affairs. While the study of botany has advanced enormously since the time when it was regarded as a harmless and elegant occupation for the female sex, its absolute necessity in any system of real cultural development is a matter which botanists have failed to emphasise, perhaps even to realise. It is, unfortunately, undoubtedly true that the immense cultural potentialities of scientific thought have too often been neglected for the sake of mere erudition. There is a general tendency for university teaching to

become more and more vocational as the specialised demands of occupations become increasingly exacting. Many there are who blame the examination system, which, however, with all its faults, if rightly used, is in reality a fairly efficient sieve for separation where large numbers are involved. But the examination machine is often expected to effect a grading of the human material with which it deals that can only be attained by more individual methods. As a consequence, undue importance is attached to examination results and a wrong emphasis is often laid on their significance. This leads to a premium being placed on mere erudition and so subjects are liable to be taught not as living realities but, in the forceful phraseology used by Winston Churchill in one of his novels, 'Knowledge is presented as a corpse which bit by bit we painfully dissect.'

Botany has been fortunate in successful avoidance of the process of fission that other subjects have suffered; but even within its bounds over-specialisation has too frequently threatened to beget disintegration. Still, the retention of plant physiology within the bounds of the wider science has saved botanists from the worst evils of the study of form unrelated to function; and the supreme value of ecology lies in the synthesis which it achieves of uniting in a single picture so many aspects of botany itself and so many branches of human knowledge.

Education Indicted

"The Informative Content of Education" was the subject of Mr. H. G. WELLS's presidential address to Section L, and in his words he laid the accent on the epithet "informative." Speaking as "a citizen at large," with an interest in public thought and public reactions, he found that what people knew and were ready to believe impressed him as remarkably poor stuff. He, therefore, wished to draw attention to the question of what was being taught as fact during the period of adolescence, even though the amount of time then devoted to instruction was appallingly meagre—2,400 hours in all. In his enthusiasm for a universal basis of knowledge, Mr. Wells perhaps underestimated the efforts—often thwarted, it is true—that are being made by the teaching profession towards attaining this end. At the same time, by the very frankness and outspokenness with which he excited some indignation, Mr. Wells has most likely succeeded in furthering the quest for *real* education. His is a dynamic personality and his words, just and unjust, have been widely reported. It is now incumbent on the teaching profession to demonstrate that they are innocent of certain of Mr. Wells' charges, and to absolve themselves as soon as may be from those which contain more than a grain of truth. Ignorance is the great enemy, and there could have been no better battleground than a British Association meeting for so vigorous an onslaught upon it.

Another vexed question of the moment was dealt with by Mr. J. M. CAIE in his address as president of Section M (Agriculture). The problem here dealt with was the intervention of the State in the vital agricultural industry. Official intervention in this direction was no new thing. At fairly frequent intervals, since the 14th century, the State had intervened in agricultural matters when the welfare of the nation as a whole seemed in danger. To-day, with British agriculture in a far from encouraging condition, the State has again stepped in with a measure of control, much of which has proved unwelcome. The Marketing Acts, for example, have given rise to much controversy; but the schemes therein involved, as Mr. Caie pointed out, are of a novel and complicated kind, and for the present, at any rate, as he said, "it is better to adjust the bearings and tighten loose nuts than to throw the spanner into the works." Other important points to consider were that, thanks to the researches of the chemist and the engineer, the output per unit of agricultural labour is steadily rising; and (perhaps most important of all) that agriculture is not only a living, but a way of life. State aid, with its attendant shadow of complete control, might ultimately be the only hope of British agriculture; but in the meantime the economic independence of the farmer was worth a struggle.

The work of many scientists was combined in an evening joint discussion of the highest importance held towards the close of the meeting, in which Sections C, D, E, F, K, and M united, under the chairmanship of Lord TRENT, to consider "Planning the Land of Britain." After an able exposition by the Chairman, Dr. DUDLEY STAMP voiced the geographer's point of view. The present utilisation of the land was a result of the interaction of three groups of factors: the geographical, the historical, and the economic. Contrary to popular belief, the geographical, or natural, factors tended to become more important with the progress of time. In an ideal world with no nationalistic or customs barriers, each piece of land would be used in the way for which it was best fitted, and despite all obstacles, the rapidly improving communications of the present time were an assistance in that direction. Meanwhile, the questions of accessibility, the physical build of the land, the soil, and the climate were points that had to be considered. The historical factors tended to stabilise land use determined by conditions no longer operative (*e.g.*, park-land, common-land), while the economic factors were operated by local conditions within the limits of the natural possibilities. Dr. Stamp, the value of whose

work on land-utilisation is well known to readers of DISCOVERY, suggested a " reconditioning " of the land, whereby it might be used to the best advantage. The most striking change would be the increase in economic forest land from 3.5 per cent. to 14 per cent. Professor P.G. H. BOSWELL outlined the geological conditions—the bones of the land on which utilisation must ultimately depend. Dr. J. S. HUXLEY pointed out the public advantages of the preservation of natural fauna, especially avifauna; and Professor SALISBURY put forward a similar plea for flora, with special reference to National Parks. Sir DANIEL HALL as an agriculturist outlined the planning of the land from the agricultural standpoint. Short-sighted destruction of valuable productive land could be prevented, he thought, only by national ownership of the land. He advocated a scheme whereby small-holders in scenic areas could supplement their annual income by letting rooms in the season to visitors. British land, he concluded, was too limited and too precious to be left to the unrestricted play of commercial exploitation. Sir ROY ROBINSON explained the position of forestry in Britain and suggested what might be done with afforestation under a general planning scheme. Professor J. H. JONES, as an economist, was inclined to view a general planning scheme with suspicion, as savouring too strongly of State socialism. He contended that the land had always been planned, according to the economic conditions prevailing at any given time. Any general scheme would have to be considered with the greatest possible circumspection before being put into practice.

Space forbids the treatment of more than a few of the fascinating problems discussed, and a purely arbitrary selection has been made among the many brilliant papers read.

The attendance at the meeting was 2027, though the announcement was not made, as has been recently customary, at the inaugural meeting. For the ensuing year Lord RAYLEIGH, F.R.S., has been elected President.

The Mechanics of Archæology

Much space has been devoted in DISCOVERY *to accounts of archæological excavation, and those of our readers who are not practised diggers will be interested in these notes on the essentials of excavation, adapted from an article by Richard Stillwell, the distinguished American archæologist, in the " Princeton Alumni Weekly."*

" How do you know where to dig ? "

The question is frequently asked of the archæologist and often the answer is hard to frame. One can reply, in a general way, that most ancient sites leave some trace in the form of ruins or débris scattered about the area. Quite often, according to the nature of the site, the archæologist who is familiar with the peculiarities of a given period can pick out an ancient settlement on geological or geographical grounds. In recent years aerial photography has played an important part in revealing the location of abandoned cities, for the artificial configuration of the ground appears in the air photograph and reveals the work of man.

When the decision to explore a given site has been taken, two major problems confront the expedition. Financing is one. The other is the matter of obtaining a concession. There is no uniform method of approach to either problem. Some expeditions are financed by private, some by public, subscription, and others are backed by institutions of learning. If the institution happens to be a museum one may be sure that the concession is sought in a country where the archæological regulations permit the exportation of some part of the antiquities found. Syria, Egypt and Palestine, for instance, permit the expedition to take home a portion of the finds, but Greece and Turkey forbid this save under exceptional circumstances. A concession is often the result of difficult and protracted negotiation, but, be it said to the credit of most of the archæological authorities, within the limits of the rules they have shown themselves eager to further the work.

Once a site has been selected and the requisite formalities complied with, including of course the all-important question of funds, more problems arise. The organisation of an expedition demands a careful consideration of personnel, for in addition to the field director there are various assistants to be selected. The smaller the staff the more varied must be the ability of each individual to cope with the many tasks that field work demands.

Sooner or later a comprehensive survey of the site will be required, and if that can be provided at the beginning of the work much valuable time will be saved. Sometimes a survey exists, as for instance at Antioch, where the French cadastral survey has been used as the basis of the excavation map. By far the greater number of sites, however, are unsurveyed, and this work must be undertaken by the expedition. The nature of the site plays an important part in the character of such a piece of work but in most cases an accurate topographical survey is essential.

Living and working quarters are also needed. Time

was when expeditions lived for the most part in tents and this is still a solution of the problem, but for more than a brief campaign or two tent life under most near-eastern conditions is not conducive to the full efficiency of the staff. Some expeditions have been housed in comparatively luxurious permanent headquarters, while the exception at Sardis built, after the first season, a very commodious house and workrooms. Excavators at Corinth eventually erected a permanent excavation house, but Poseidon, the earthshaking god, did not appear to approve of this step, for no sooner was the house completed than a severe earthquake drove the staff to a term of tent life. At Antioch the staff lives in a picturesque old Turkish house and works in a former cavalry barracks.

After establishing the expedition in suitable quarters the question of securing workmen must be solved. In this connection it must be said that perhaps the most valuable man connected with an expedition, outside the field director, is the foreman. On him largely depends the progress of the dig, and an efficient foreman is well worth his pay. His primary function is to keep the men at work and to see that they work carefully. He should have experience in archæological digging and know how to obey instructions. If some change in digging conditions arises and a member of the staff does not happen to be present, he should know when to stop work in a particular spot until the change has been recorded. An over-enthusiastic foreman can, through sheer ignorance, destroy valuable evidence and do incalculable damage in a very short time.

Excavating is not, as many are likely to believe, a mere matter of moving so many tons of dirt. Neither is it, save in particular cases, a matter of sifting all of the earth removed. Both elements enter into the problem but each has its time and place, and it is the part of proper archæological supervision to determine which it shall be. There are times when the surface deposit is deep and relatively insignificant, and the question is asked: "Why not use a steam shovel?" Generally speaking, steam shovels are hard to obtain. And they are costly—more so, in fact, than the wages of the men needed to dig out the area. Moreover, a steam shovel lacks the finer sensibilities and has little respect for any save the firmest of walls. An experienced workman will turn up delicate terracotta objects, such as lamps, with the point of a heavy pick, and unless he is particularly unlucky will hand them over quite intact. Naturally, as soon as a workman discovers the presence of a number of objects—statues, terracottas, or pottery—the use of excavation tools becomes much more meticulous. The artistry of certain native specialists in careful digging is amazing, and a deposit of pre-Hellenic vases scattered about a chamber tomb will be laid bare for photography and record without disturbing a single pot.

The immediate consequence of taking earth out of a trench is the necessity of finding a place to put it, and dumping is one of the vexing questions that frequently arises. Trial trenches, destined to be refilled, will have the excavated earth piled near so that it may readily be thrown back, but almost always it will be found that any desired extension of the trench will run in the direction of the dump, and necessitate shifting a part if not the whole of it. Sometimes a convenient ravine may be used, and sometimes a field is leased for dumping purposes and then returned to the owner, somewhat elevated and usually not a little improved by the addition of fresh soil.

The Ubiquitous Petrol Can

Apart from clearing the site, the archæologist is responsible for recording and conserving it. Included in the equipment of any expedition must be the means of keeping records, catalogues, etc., and of measuring, mapping, and photographing the ruins and the objects found. Containers for collections of pottery sherds from different levels are always in demand, and the visitor to the shops of a field expedition will find cardboard boxes, wooden trays, and the ever-present five-gallon petrol tin (without which the Near East to-day could scarcely exist), all serving such a purpose. The amount of material taken from an excavation is amazing, and only a small part of it has any intrinsic value or appeal to anyone save the archæologist. Each piece must be cleaned, recorded, numbered, and in many cases photographed or drawn up. Small wonder that the excavator's life is a busy one and that an excavation staff works on the average twelve hours or more a day!

The preservation of antiquities that must be left *in situ* is also one of the responsibilities of the expedition. Many things are best covered in again after being studied. Some sites can be adequately guarded, but often considerable work in consolidating the ruins is necessary. At Antioch, where a great number of mosaic floors has been found in widely scattered areas, it would be impossible to provide adequate guards, and equally impossible, for lack of funds, to build a new and secure house over the series of valuable floors. The only alternative is to refill the areas or to raise the mosaics and transport them to the storehouse. The removal of a floor has the advantage that it is then possible to dig beneath it and discover by coins or other signs the date after which it must have been laid.

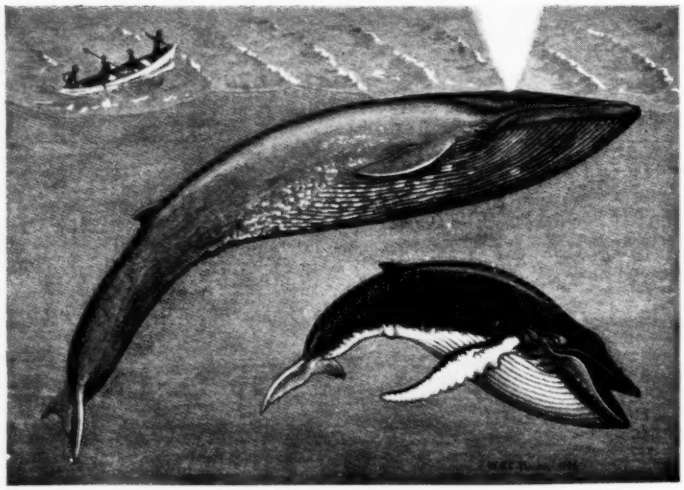
It must be remembered that to excavate a site is, in a great measure, to destroy it, and the responsibility that faces the archæologist is a grave one.

Sperm Whale and Squid

By N. W. Gregory Walker

Although whales have been studied scientifically for nearly two hundred years there are still many problems concerning their behaviour lacking explanation. In this article the strange ways of these mammals are fully discussed.

Of the world's two largest animals it may be said that one lives by eating the other. There has never been an animal as large as the whale, which can be 100 feet long and weigh 100 tons. A 100-foot dinosaur was mostly neck and tail, and in ton-weight must give place to the whale, which left the land for the sea and so survived while the dinosaurs perished. Though the sperm whale or cachalot (*Physeter catydon*) is by far the largest of the toothed whales, it is not to-day found as large as the so-called "sulphur-bottom," which is nothing but a blue whale that has become coated with the micro-organisms known as diatoms. Nevertheless the sperm whale is an immense creature, that has no enemies but man, for it can out-fight anything that swims.



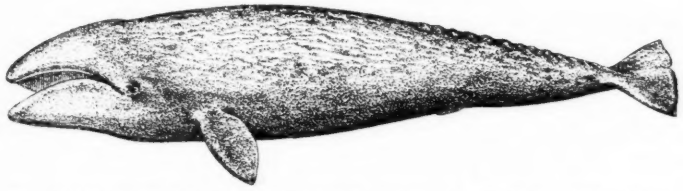
A Blue Whale and (below) a Humpback Whale. (From "Giant Fishes, Whales and Dolphins", by J. R. Norman and F. C. Fraser, published by Putnam.)

The largest sperm whales may well have been killed out. The blue whales—with a sieve of baleen instead of teeth—have not been killed until recently, as they were too fast for the old methods of hunting and sank as soon as they were dead. The sperm whale has been slaughtered for well over a century, and, though it has been presumed to live from forty to fifty years, yet no one knows its possible age. To-day one does not hear of cachalots beyond sixty feet long, but Herman Melville, writing in 1850, gave eighty-five to ninety feet as a certain length for the largest sperms, though he had heard from whalemen of ones larger still. Unfortunately the old-time whaleman, who saw these whales when they were in numbers, estimated them only in terms of barrels of oil.

The sperm whale needs about a ton of food a day, and his chief food is *Architeuthis*, the great squid, the clear original of the awful Kraken, which flung its arms round ships and drew them into the ocean depths. Since the squid is not compact like the whale, to realise its possible size we must be clear about its shape. Both cuttles and squids are decapods, and with the octopods they form the class *Cephalopoda*, all of which have beaks and eject sepia. Squids and cuttles have, hidden in their bodies, the remains of former shells; but the cuttle "bone" which we give to the canary is, in the squid, represented by a horny "pen" of the shape of a flat, pointed feather. The squid is further distinguished by two vanes just short of the end of its cigar-shaped body, and by the extreme prolongation as tentacles of two of its arms. The head, set on a gristly neck, ends in a crown of arms, in the midst of which is the horny parrot-beak, designed to break up fish and crustacea. Each arm is thick-set with suckers, but, as if that were not enough, in many species the suckers are rimmed with tiger-like claws as sharp as needles. The tentacles end in expanded palms, also set with suckers, and many of these creatures have a device for locking the hands together at the wrist, so as to increase the power of their grip. Lastly, we must add to these horrors the enormous eyes, like pools of ink and up to fifteen inches across.

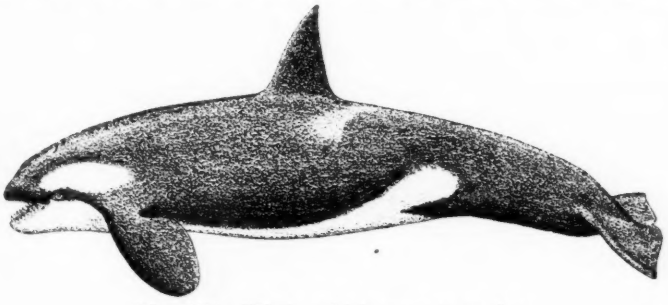
The giant squid is certainly the largest invertebrate animal, and rivals the vertebrates in strength, swiftness and efficiency. It has been found in the North Atlantic, North Pacific and Southern ocean, and is thought to be absent from tropical and sub-tropical seas; but it is here suggested that the whale finds it in warm latitudes if there is an upwelling of a cold current on the slopes of submarine mountains. Of the squid's possible size

we have no knowledge, for it lives at great depths, and it is seldom that more than fragments of it are washed ashore. Even a cautious writer will allow it a length of fifty feet, including the tentacles.



The Californian Grey Whale, which grows to 45 feet. (The three illustrations on this page are from "Giant Fishes, Whales and Dolphins".)

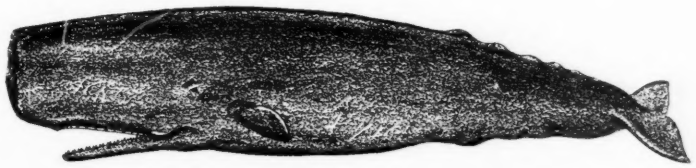
The whalemen can help us in our inquiry, for a dying cachalot disgorges its food. Melville speaks of the ejection of detached "arms" of squid exceeding thirty feet in length. C. W. Ashley (*The Yankee Whaler*—1926) says, "a sperm whale in his flurry will sometimes vomit pieces of squid which are half the size of a whaleboat." Frank Bullen, who examined similar fragments, writes, "here was a kind of whale that could swallow—well, a block of four or five feet square apparently; who lived upon creatures as large as himself, if one might judge of their bulk by the sample to hand; but being unable, from only possessing teeth in one jaw, to masticate his food, was compelled to tear it in sizable pieces, bolt it whole, and leave his commissariat department to do the rest." He speaks also of examining "a massive fragment of cuttle-fish—tentacle or arm—as thick as a stout man's body, and with six or seven sucking-discs or *acetabula* on it." In his *Creatures of the Sea* he declares that he saw a squid



The Killer Whale, which grows to 30 feet.

being devoured by a whale, and that the squid's length could not have been much less than sixty feet exclusive of the tentacles, while its girth would be about fifteen or twenty feet. This was a fight where the squid's size had driven the whale to bring it to the surface. Such an estimate is somewhat staggering, but who can say that it is impossible? Abysmal forms of cephalopods have been found at 2,000 fathoms—12,000 feet—and only the whale can drag the great squid from its home.

Hyatt Verrill (*Strange Sea Shells*—1936) states that the particular squids that came ashore at Newfoundland and were measured by his father, Professor Verrill, for the American museums, had bodies twenty feet and tentacles fifty feet long. Writing as a student of the mollusca, he asserts that fragments ejected by whales show the existence of squids far larger than those just mentioned. More is known of the sperm whale than of the giant squid, but it still offers a number of problems. It is, by the way, the only one of the major whales that will attack its pursuers when it is not in the death flurry. On several occasions it has deliberately rammed



The Sperm Whale, which grows to 60 feet.

and sunk ships. The old whalemen, attacking it from boats, usually found that the longer a sperm whale fought the more determined and cunning it became. Some individual cachalots, indeed, were well known to be particularly dangerous and best left alone; for example, a century ago, there was "New Zealand Tom," who was said to be of great size, and who could be told by his white hump.

Unlike other whales the cachalot is gregarious, and sometimes collects in herds numbering several hundreds, so that their spouts can be seen to the horizon. Half-grown males keep together, as do the young males, while the young females place themselves under the protection of the old cows. The normal organisation is in schools of cows with one, two or three old bulls, who allow no rival unable to establish himself by a fight which often leaves its traces in injured teeth and even in twisted jaws. When the old bulls are unable to maintain their position in the herd they pass the rest of their lives in solitary roaming. They may be found anywhere, and it is these lone bulls

that were held by whalemen to be the most savage and cunning of all the whales that they attacked.

Most of us know that, while a baleen whale would choke on a four-pound loaf, the cachalot could swallow a man. It is, of course, a mammal, and occasionally bears twins. Its distinction from a fish is clearly shown in that it has no gills, breathes through a hole in the top of its head, and has a horizontal tail. This last works with a sideways, sculling movement, and only a killer whale can "go astern." The flippers are used as balancers, and their interior bones, resembling those of a human hand, reveal a descent from a land animal, while detached pelvic bones provide the remnants of hind legs. The strength of the animal seems to run into its twenty-foot tail, which will drive the vast bulk at a cruising speed of three to four miles an hour; though this can be increased to ten or more when the whale is "going head out," and it is said to be capable of a rush of twice that pace just after it has been struck by a harpoon. Old whaling pictures that show a boat's crew hurled skyward with the remains of their craft are not, for that reason, exaggerated. With a blow of the tail flukes the mate of the *Tuscan* was swept forty yards out of his boat and killed instantly.

Cuttle-fish scars on the blubber of a Sperm Whale. The suckers have taken hold, but been dragged away; the claws round each disc have scored lines. The squid has attempted to get a second hold. (The deep gashes were not made by a squid).

The cachalot has strange movements quite distinct from swimming. In "breaching," it provides one of the world's greatest sights, by shooting twenty feet clear of the water and falling flat. In "lobtailing," it stands on its head with its tail some thirty feet out of the sea, in which position, waving the tail violently, it hits the surface with strokes that can be heard for miles. When "milling," it stands upright, with its head out and little pig eyes above the surface, while it turns slowly to watch an approaching danger. The eyes, the size of a horse's, being set near the angle of the mouth, cannot look behind; nor can they look straight forward, unless perhaps when the head, which has channels in its sides, is raised. The whale, therefore, has two separate fields of vision. We can speak only of its sight when on the surface, and there it seems to be poor. Its sense of hearing—or, at any rate, its awareness—is acute, though so small is the opening of the ear that a pencil can hardly be pushed into it. The blubber which encases the body has an average thickness of six inches. It is not a soft fat, for only the sharpest knife will cut it. In colour it varies from yellow to cream, and its condition varies enormously. It is almost certainly a reservoir of nourishment, besides being an insulator against heat and cold. The grey-black outer skin upon it is so thin that it can be scraped off with the finger nail.

Roy Chapman Andrews writes, "Of all strange animals which live in the sea the sperm whale is certainly one of the most extraordinary; whenever I look at one I feel like saying with the country boy who had seen his first camel: 'There ain't no such thing'." Certainly no mammal has such an abnormal cranium. For an example, although the cachalot shares with other whales an asymmetrical head and ribs, it is peculiar in having a single spout hole on the left side of its "snout," the right nostril and its passage having become suppressed; though how this has come about is not known. This "lopsidedness" of the bony structure may bear on the fact that when a cachalot goes into a flurry it usually circles to the left. The bulk of the skull is set back twenty feet from the forehead, and, looking at the long beak-like jaws, no-one could imagine that over them is built an immense boneless mass, rising vertically until it turns to form a line with the creature's back. Though its corners are well rounded, the forehead, from the front, appears as a wedge tapering downwards. So tough is the head that a hand-thrown harpoon merely bounces from it, though it is often found scored an inch deep by squids.

The lower portion of the head above the jaws is composed of a honeycomb of six-inch chambers and six-inch bulkheads—a reservoir of oil, called by whalemen the "junk." Over the junk is the "case"—a tank filled with clear liquid spermaceti, tasteless and faintly scented, which is not an oil but a wax and hardens on

exposure to the air. Its commercial value is in its use as a stiffening for paraffin candles and a base for high-grade cosmetics. Its use to the whale is still guesswork, but it has been suggested that it has a valvular function in closing the nasal aperture. A full-sized case yields about 500 gallons of spermaceti, which will be less surprising if we remember that the head is a third of the length of the body. All sperm oil contains spermaceti, which is especially rich in the junk.

The lower jaw, set well back, often carries fifty teeth, which fit into bony sockets in the upper jaw, the whole apparatus being well designed to hold the slippery bodies of cuttles and squids, and to tear large specimens to pieces. Fish, sharks and lobsters have been found in a whale's stomach, but probably they were mere casual pickings-up, and an observer who has examined six sperm whales that had been hauled ashore at South Georgia says that he found in them nothing but cephalopods. There is no question that this main food is found at great depths, or at any rate lurking in the drowned precipices at the edge of a continental shelf. As we shall see in a moment, there is no question of the great depth to which the sperm whale will descend, though there is no satisfactory explanation of how he manages to do it. It has been computed that a large whale at a depth of 800 fathoms is subjected to a pressure of 211,200 tons; which is a good deal more than the combined weight of the *Queen Mary* and the *Normandie*! He certainly does not swallow water, which would kill him as readily as it would an elephant. Decidedly he has no gas bladder, if only because in that case he would burst like a deep-sea fish when he comes to the surface. Is there a clue in the way in which, when harpooned, he will sometimes "settle" like a stone? It has been thought that he may have a power of contracting his body, which movement would both sink him and help him to resist pressure.

A Methodical Whale

Certainly the cachalot beats all other whales in submerging, which he does regularly for a period that extends from ten to twenty minutes beyond an hour. How does he get air—unless his very curious vascular system provides him with a special supply of oxygenated blood? Consider his behaviour when coming to the surface—where he spouts air which vaporises. This spout, by the way, is visible under all conditions, even on the Line; perhaps because gases under pressure are instantly reduced in temperature when suddenly released. Whalemen know that this most methodical of all whales will "have his spoutings out," and, if disturbed, will dodge up again to finish them. Each whale has his fixed number of spouts, and, by a whaleman's rule of thumb, will stay below a minute for every foot of his length, and spout the same number of times when he has finished feeding. In other words, a sixty-foot sperm will stay down sixty minutes and spout sixty times when he emerges. In the daytime, at any-rate, cachalots are seldom found sleeping on the surface, and one may guess that one good reason for this is that, if lying exposed and motionless, they are liable—quite literally—to be eaten alive by birds. It is probable that, when their muscles are at rest, they remain below for much more than an hour.

Entangled in Cables

In the old sperm fishery it often happened that a struck whale took down—apparently straight down—nearly a mile of line, and, after perhaps an hour's "sulking," came up within a few yards of the whaleboat. A whale thus sounding seemed exhausted when it reappeared. Bullen tells of a whale which vanished with 7,200 feet of line to which had been bent four drogues, each of which was supposed to impose a drag equal to that of four thirty-foot whaleboats. It cannot be said in what direction this whale went, but here are some facts: a cable ship, grappling an injured cable off Ecuador, found a thirty-foot whale caught in it by the lower jaw at a depth of 280 fathoms. Another was found off the Peruvian coast entangled in a cable which had broken in 500 fathoms. A fifty-foot whale was similarly entangled, off the west coast of South America, at 540 fathoms—over three-fifths of a mile. All these whales were sperms, and probably took the cables for the tentacles of squids.

The distribution of the cachalot has been plotted on information given by logbook records dating from 1761 to 1920, representing a total catch of 36,908 sperm whales. From April to September they were found roughly between 40 deg. N. and 40 deg. S. The densest patches showed on the Japan Ground, in the North Atlantic above 25 deg. N., and on the Line from the Gilberts to Ecuador. From October to March the whales followed the summer, and gathered roughly between the equator and 40 deg. S., though some hung on in the north until December.

There were curious odd gatherings, as at the Twelve-Forty Ground (12 deg. N. and 40 deg. W.) from February to May inclusive; at the Kermadecs in April and May; and on the coast of Japan in May, June and July. In October and November the Charleston Ground (U.S.A.), the Azores, and the coasts of Arabia and Ceylon were frequented. Off the present British New Guinea and Papua whales collected thickly from October to March inclusive, and left in April. Over a dozen times sperm

whales were taken off the Horn in summer, for the most part in January.

Since October last the Government research ship *William Scoresby* has been marking antarctic whales as though they were birds, except that the whales' tallies are darts shot into their blubber. The information gained when the whale is killed should be of great interest. Meanwhile, however, the slaughter goes on with modern methods. In the present century many more than 200,000 whales have been taken in antarctic waters, and a further ten per cent. lost. Nevertheless it is not only the blue whales that are suffering in the far south but the sperm whales in both hemispheres, and one whaling company in British Columbia landed 173 sperm whales in 1934 and 175 in 1935.

We are sometimes told that the position will settle itself, and that before the whales are wiped out their pursuit will be discontinued as unremunerative. This seems neither particularly scientific nor very reassuring. Apart from the value of the whale, if properly protected, for providing oil, meat and fertiliser, man's record witnesses to the obliteration of too many living creatures. When Hobart, Tasmania, was first founded in 1804, it was often unsafe to row across the harbour by reason of the whales, which then visited Tasmanian estuaries in immense numbers, coming each winter between May and November, and leaving with their calves as summer advanced. Bay whaling stations were established, and worked themselves out by 1841. The whales that were watched for as they made their passage past the South West Cape—Tasmania's Cape Horn—no longer came; and this was in one corner only of the world.

It is quite likely that whales know very well when an area is unhealthy for them, and whereas the old-time whale-ships combed every corner of every sea, modern ocean traffic, running on a few fixed routes, leaves vast areas of ocean deserted as they have not been for centuries. Is the sperm whale taking advantage of these peaceful regions? For when it shows itself in certain quarters it stands very little chance. Perhaps an answer to this question would throw light on its prospect of survival. Perhaps, also, there is not much time to lose.

The Royal Research Ship *William Scoresby* left London last month to continue her whale marking operations in the Antarctic to gather information on the migration of whales. This unusually early departure is intended to enable her to mark whales before the whaling season begins. When a marked whale is taken by a whaler, the dart is sent to the Colonial Office with particulars of the place and time at which the whale was killed. Last season the ship marked 900 whales.

Birds Killed by Wires

TOWN-BRED pigeons become, by practice, most skilful at noticing and avoiding telephone wires, radio aerials, electric cables and similar dangers. But wild birds are less wary: throughout the year considerable numbers suffer fatal crashes, and during the chief months of migration (March–May and September–October) there are always many reports of dead and dying birds beneath the wires.

Some uncommon birds were included among the victims last spring. A waxwing was found beneath a wire on the Island of Mull, Western Scotland. From elsewhere a peregrine falcon and a Bewick's swan were reported. (Once a swan crashed into some electric cables in Shropshire so vigorously that a large area was plunged into darkness.) A stone-curlew and a quail were among other recent victims, the one in Norfolk and the other on Salisbury Plain.

Tram cables once felled a landrail at Bexhill-on-Sea, and a year or two ago an overhead wire brought down a jack-snipe into St. James's Street, in central London. A gamekeeper, complaining about the mortality which wires and cables caused among grouse, noted that: "In addition to grouse I have picked up snipe, plover, coot, several species of the thrush family, blackbirds, wheatears, sandpiper, wild pigeon and mallard." And I have myself picked up wounded gulls beneath wires, and seen an oystercatcher brought down.

Partridges and pheasants both suffer—especially from telephone wires—but it is grouse which provide the greatest number of victims. Last February a keeper wrote: "Once again we are having casualties amongst the grouse; a number of them have been killed by flying into the overhead cables. Unfortunately the majority are hen birds. Within the last twenty-four hours, we have picked up six hen birds and one cock."

Grouse fly even into the thick cables (and the pylons themselves!) of the Central Electricity Board's grid. Not only in fog, when casualties are specially liable to occur among all birds, but even in broad daylight. The chief reasons are probably two. First, though the cables, outlined against the sky, look so obvious to the human eye, they are not at all easily seen from the birds' higher viewpoint, since the cables then have a dark background of moor. This analysis is supported by the fact that certain stretches of cable prove very much more deadly than others. Secondly, birds which habitually fly in coveys tend to rely on their leaders. And the leaders—wary old birds—see the danger just in time and slip through, but many of their trustful followers crash, often with fatal results.

J. D. U. WARD.

The Brazilian Wax Palm

By A. J. Bigley

THE Carnauba Wax Palm, or Carnaubeira (*Copernicia cerifera, M.*), is one of the most beautiful and most useful of Brazilian palms. Its smooth, tapering trunk rises, slender and elegant, to a height of 130 feet, and terminates in a spherical bunch of circular leaves, carried on long, curved and thorny stems. The leaves, measuring about four feet in diameter, are split into ribbon-like segments round the edges, forming wide, drooping fringes.

This beautiful palm is found only in north-east Brazil, between Pará and Bahia. In Ceará, which is its favourite abode, it covers great tracts of country with extensive open woods, free from other trees and from the rope-like creepers which render many Brazilian forests impenetrable. A large part of the State suffers periodically from prolonged droughts, during which the rivers and streams dry up, the trees shed their leaves and the earth becomes stripped of all but a few withered stalks of grass. The Carnaubeira alone continues to thrive, as its long roots strike deep into the earth in search of water, while the layer of wax on its leaves reduces evaporation to a minimum.

As soon as the rains are overdue panic seizes Ceará's scattered inhabitants, and many seek refuge in the villages or migrate to neighbouring States. Others cling to their homes long after their crops have perished, hoping the rains will come and restore life to the parched earth. To these the Wax Palm offers food and drink. The white, sago-like pith of the young plants, containing starch, cellulose and inorganic salts, is made into puddings. The pulp of the fruit yields a mealy substance, like ground corn, which provides them with bread. The terminal shoot, resembling asparagus in flavour, is a vegetable delicacy much sought after in the towns. The nuts, rich in oil, albuminoids and cellulose, are eaten raw or boiled. The leaves and the residue of the fruit furnish fodder for the cattle. The juices of the terminal shoot and the sap of the stems provide a refreshing drink. In times of plenty they are fermented to make wine for festive occasions, and the nuts are roasted and ground as a substitute for coffee. A pleasant potable liquid is also extracted from the roots. This is extensively used throughout the countryside as a blood purifier and a remedy for arthritis and other similar diseases. Some years ago an unsuccessful attempt was made to introduce it into England. After extracting the liquid the roots are burnt, the ashes, composed of chloraurate of soda and potassium, being used by the peasants in place of ordinary table salt.

In normal times the Carnaubeira fills many other wants. The trunk is used for all kinds of rustic constructions. Split and hollowed out, it serves to convey water from the streams to the plantations. Brooms, brushes, and furniture are made from the resistant stalks of the leaves, while the latter yield an excellent fibre from which hammocks, ropes, mats, baskets and hats are woven, the residue being used to stuff mattresses and to make paper. Commercially both the fibre and the wood are of value. Selected fibres are used to make up "Panama" hats, and the tall, straight trunk is peculiarly suitable for telegraph poles and bridge piles. In salt water it is practically imperishable. The wood, dark green in colour, easily worked and polished, is in great demand for walking sticks and is also used in cabinet making.

But the wax which coats the leaves of the Carnaubeira represents its real commercial value. Detached by drying and beating the leaves, it is then melted and pressed into cakes for industrial use. It has a specific gravity of 0.995 at 15° Centigrade, and is harder than any other vegetable wax, melting at 85° Centigrade. When dissolved in ether it forms a crystalline mass which only melts at 195° Centigrade. The colour, which varies from light grey to dark yellow according to the age of the leaves and the tree, indicates the percentage of oil and the quality of the wax.

(*Continued on p.* 316)

Courtship and Female Selection

By C. D. Roeder

The author seeks to prove, by his own observations on deer, that selection in courtship depends largely upon the female.

"In mammals courtship is less frequent and, when present less spectacular than in birds. Often, as in deer and wild sheep, bisons and sea-lions, there is no courtship, but the males fight for the possession of the females, who passively fall to the lot of the victor. Such males are naturally characterised by weapons and prowess in fighting, and display decorations are absent."

The paragraph above is taken from *The Science of Life*, by Wells and Huxley. It seems a little injudicious that the statement it contains should be so categorical and backed by two names of such eminence. A misconception on a matter of this kind is apt to do considerable harm as it fosters and encourages the idea of male superiority, which, as a matter of fact, is rarely based on anything more substantial than male vanity.

Unfortunately, I have never had an opportunity of watching the courtship of wild sheep, bisons or sea-lions, under natural conditions, but where deer are concerned I have enjoyed many hours of long and careful observation. During forty years I cannot recall any incident which led me to believe that female deer fall passively to the lot of the victor, and as regards display decorations surely the antlers, grown specially for the rutting season, the maned neck of the stag and the sudden development of his powerful voice should not be forgotten. It has always appeared to me that the first impulse towards courtship emanates from the female, however unconscious she may be of it. It is well known that a hind who has not been fertilised during the rutting season in October will occasionally come into season again during the following spring or summer. On these occasions one may hear the rutting call of the stag at a time when he usually maintains a strict silence. This seems to indicate that the female desire awakes the male instinct at a time when it is usually supposed to lie dormant.

At the Zoological Gardens in Regent's Park an old Indian stag shares an enclosure with two hinds. One of these hinds appears to have been barren during the last two years, with the consequence that the stag's rutting call can be heard long after the season is over and, what is more, he can be seen covering the barren hind with her full consent.

As this observation was made on animals in captivity it may, perhaps, be as well to ignore it, but in the forests of Germany stags are occasionally heard in June and in such a case every effort is made to shoot the hind in question in order to prevent her from forming the habit of producing non-viable offspring in February.

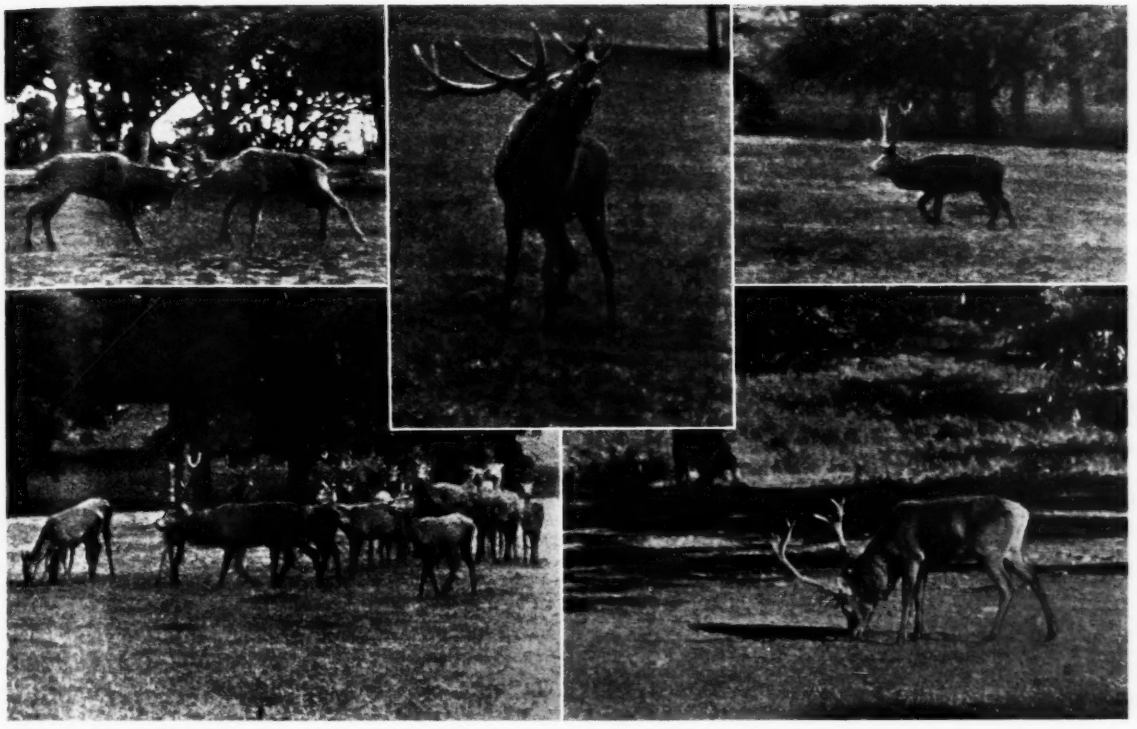
As fallow deer inhabit the great parks around London in large numbers, their courtship can be easily observed by anyone during the latter half of October. At this time the older bucks usually congregate in some particular locality, where they commence their very unmusical performance by loud and continuous snorting. Each buck selects his site and frequent fights take place for the right of sole proprietorship. The hinds, when they feel that way inclined, are evidently attracted by the bucks' rutting call. They appear to come on the scene quite casually but soon capture the attention of the nearest buck, who makes strenuous efforts to retain the visitors on his site by increased snorting and the expulsion of his possible rivals. He attempts to prevent any hind from leaving the circle which his constant gyrations have marked out on the soil. In this, however, he does not succeed if any hind seriously wishes to leave him, as she is considerably faster and more nimble than the buck.

Bored Hinds

As soon as the buck has a few hinds in his circle he pays them much attention and obviously courts them. The hinds apparently enjoy his performance, but are not necessarily favourably impressed by it. One or two of them will get bored and join the circle of another buck, where the same thing is likely to happen after a short sojourn. During all these preliminaries the hinds show no sign of consenting to the sexual act, which they avoid with ease, in spite of the importunities of the buck.

Although there are many fights among the bucks I have never seen a hind fall passively to the lot of the victor. On the contrary there was every indication of a careful female selection, which went so far as visiting a number of prospective mates before a decision was arrived at. The older bucks are nearly always preferred.

The hind indicates her readiness to accept a particular buck quite unmistakably, by licking her own flank, and I have never seen mating take place without this little preliminary, which again appears to show that the choice lies with the female and that she is not prepared to be a passive victim. On observing this little sign of encouragement the buck redoubles his efforts and mating soon follows.



Some scenes in the deer's life: Top, left to right, "Rivalry," "The Challenge," "Who Dares?"; Bottom, "The Harem," "A Snack."

Red deer can also be easily observed in the great parks surrounding London, and as they excel the fallow deer in size, beauty, grace and voice, they are more fascinating to watch. They are possessed of far more dignity, and I can imagine few finer sights than a great stag sending out his challenge over mountains and valleys as the first rays of the October sun penetrate the morning mist. As one watches the stag, with his herd of hinds, one is apt to feel convinced that here, at last, is the real sultan of the harem and that, by strength and undaunted courage, his maleness reigns supreme. Nevertheless, one would be mistaken, for there can be very little doubt that the real power again rests with the eternal feminine and that, in spite of the stag's passionate courtship and apparent domination, it is the hind who decides the fate, or at least the pedigree, of the next generation.

By means of his magnificent voice and the expenditure of incredible energy the stag succeeds in rounding up a herd of hinds and driving off his weaker rivals to a respectful distance. His success up to this point does not, however, mean that the hinds fall passively to his lot. Various reasons cause the hinds to remain with his herd, but they seem to reserve to themselves the right of choosing the father of their next year's offspring. One reason for joining the herd of the strongest stag is probably that his presence and jealousy frees them from the too persistent molestation of other stags, all mad with the passion of October.

A large proportion of the hinds in a herd are no doubt covered by the master-stag, and their choice is natural enough as he is obviously the best stag in the neighbourhood, but that must not be allowed to blind one to the fact that the final choice of a mate always rests with the female among animals. No stag can force a hind to accept him as her mate, as that is a physical impossibility. I have seen a hind leave the herd of the master-stag and mate with his rival two or three hundred yards away and then return quite unconcernedly to the herd, which no doubt contained most of her friends. Although the master-stag had attempted to prevent her little excursion he was powerless to do so and evidently bore her no ill-will on her return to the fold.

I have seen a hind courted and pursued by half a dozen stags, who all failed to win her compliance, allow herself to be covered by an old stag, who had put out his shoulder and could hardly stand. In this case the stag had lost the whole of his herd and was lying down alone nursing his injury. It was almost necessary for the hind

to help him to perform the sexual act, and as the stag could barely walk a dozen yards she certainly did not fall passively to the lot of the victor. The old fellow was certainly a champion and no other stag dared to approach him in spite of his injury, but there was no motive to cause the hind to approach him either beyond her own free will and desire.

Again, I have seen a hind to whom the fourteen-pointer master-stag of the herd had paid every attention for some two hours allow herself to be covered by a royal, who managed to approach her end of the herd for two minutes while the fourteen-pointer was engaged in driving off another rival at the other end of the herd.

Among roe deer courtship takes a somewhat different course. Unfortunately, this most beautiful and graceful of all European deer cannot be seen in any of the more popular parks on the outskirts of London. Space will not permit a detailed description of its fascinating courtship with regard to which there are even more misconceptions than those in existence about red and fallow deer. The most widely believed fable about roe deer is that they are monogamous. The buck is certainly often seen with only one doe at a time, when the fires of passion burn at white heat, but to describe him as monogamous is to underestimate his immense vitality. I do not think that I have seen a monogamous roebuck in forty years.

I could multiply the incidents I have watched almost indefinitely, and I am convinced that courtship and female selection takes place among all the higher animals. What would happen to Mr. Porcupine if Miss Porcupine were not willing ?

The Brazilian Wax Palm

(*Continued from page* 313)

Carnauba wax ranks next to cotton in the economy of of Ceará, and is becoming of increasing importance to that State owing to the new applications which are constantly being found for it. The Indians polished their bows with it, and mixed it with oil to soften skins and leather. The early Portuguese settlers made candles of it and used it as lamp-oil. Later it came into favour for varnishes and was extensively employed in the manufacture of lubricants, soaps, ointments, electrical insulators, and gramophone discs. In the textile industry it is used to give gloss to cotton goods, and during the war picric acid was obtained from it. Nowadays it is mixed with resin and paraffin to render paper and cardboard impermeable for the manufacture of cheap, hygienic food receptacles, cups for cream, and the like.

Early Man in Brittany

Hitherto it has been accepted generally that Brittany, that important centre of the megalithic culture in Western Europe, afforded no evidence of a palæolithic age, nor in fact of any occupation by man before the neolithic period. From at least two sources evidence is now available, which suggests that these views must be modified and in part abandoned. Recent investigation of the quaternary deposits of the cliffs in the bay of St. Brieuc (Côtes-du-Nord) has revealed indications of palæolithic industries of two distinct periods, while excavations on Téviec, a rocky islet, off the shores of Quiberon, have uncovered an extensive habitation site and necropolis of mesolithic age.

The quaternary deposits of the cliffs of St. Brieuc, according to a note contributed to the current issue of *L'Anthropologie* (T. 47, 3-4) by M. R. Mazères, by whom they have been examined, include a lower and upper loess. Of these the latter shows evidence of two periods of deposition, from the earlier of which have been obtained a number of implements of flint of Mousterian facies, flakes of diabase and other stone showing the same technique, animal bones of indeterminate character, and the tooth of a reindeer. The use of a stone other than flint is to be attributed to the scarcity of the latter material in the neighbourhood. The later deposits of loess afforded two well-formed carinated scrapers of Middle Aurignacian type, a tooth of a reindeer and a tooth of one of the *Bovidæ*.

The mesolithic site at Téviec is probably the most extensive and complete of its kind yet to be examined in Western Europe. It has been excavated by M. and Mme. Saint-Just-Péquart. It was composed of kitchen-midden material, which though indurated, crumbled readily owing to the amount of organic matter it contained. The site originally had been much larger; but it has suffered much from marine erosion. A number of burials were found with the skeletal remains, not all complete, of twenty-three individuals, twenty-one of them fairly well preserved. At the time of the occupation the island, apparently, was joined to the mainland; but the inhabitants lived a riverine rather than a marine life. They were not, however, either hunters or fishers; and their diet was largely composed of shell-fish.

The discovery of a quantity of flint implements of diminutive size and geometric shape, of Tardenoisian type, confirmed the attribution of the site to a mesolithic age. This station, the first of its kind to be found in France, is of importance not only as affording a type station for France, but also for archæology at large, as a connecting link between the mesolithic cultures of northern and southern Europe.

The March of Knowledge

Television for the Deaf

There are, in the Tower House Home for the Deaf and Dumb, Belvedere, a number of men who are not completely stone deaf, and they have been in the habit of listening to the wireless by special amplifying headphones. Some of them, however, are unable to distinguish between music and talks—and so the radio was providing very little entertainment. To be able to see at the same time, however, provides an interpretation of the sound. It has been found in actual fact that the co-ordination of the aural and visual faculties does assist the men to hear, or to understand what they are hearing, and, accordingly a G.E.C. television set was recently installed at the Home. Among the patients is an ex-soldier who was deafened in the war, and he has heard for the first time since the G.E.C. attached their special headphones to the television set. The headphones are attached to the output of the receiver by means of a special matching transformer which provides means of varying the sound characteristic to suit the traces of aural response shown by the patients. The receiver itself is a 23-valve superhet model with a direct vision television picture.

Heavy Nitrogen

Professor Harold C. Urey, well known for his discovery of heavy water, announced at the American Chemical Society's Convention that he and his associates at Columbia University had succeeded in producing heavy nitrogen in quantities sufficient for research experiments. This heavy isotope of nitrogen differs from ordinary nitrogen in that it has one additional unit of atomic mass. Its atomic weight is 15 times that of hydrogen, while that of ordinary nitrogen is 14. It can be produced by Professor Urey's process at the rate of one-third of a pint a day. The value of heavy nitrogen for research in physiological chemistry is inestimable. In particular it will make it possible to discover much about the action of the body on protein.

Depositing Gold Films

Examples of what is described as a new and easy method of depositing films of pure gold on glass and other surfaces have been lent by the discoverer of the process, Professor Charles S. Gibson, of Guy's Hospital Medical School, to the Imperial Institute, South Kensington. The films deposited are so extremely thin—the thickest is only 0.0004 mm. in thickness—that they are transparent, showing a beautiful greenish blue colour. Though of pure gold, deposited chemically, the actual amount of gold used in filming a surface is stated to be extraordinarily economical. For example, among the exhibits is a convex mirror of about six inches diameter, and the cost of the gold used in backing it was only one-eighth of a penny. The thickness can be varied by altering the conditions of the reaction and the quantities of the reagents. The necessary starting material being available, the pure gold films are actually more easily produced than those of silver, and are much more chemically inert. Professor Gibson considers that this new and ready method of deposition may have considerable scientific application.

The Phonostethograph

The important new invention called the Phonostethograph enables heart-beats not only to be heard loudly and clearly but also to be recorded like a gramophone record. The inventor is a doctor trained at King's College Hospital, London, and all his experimental work, including the building of the first working model, was carried out at King's. If necessary, heart-beats can be " wirelessed " so that a patient in a liner in the mid-Atlantic can be attended by a Harley Street specialist, who can give his opinion and advice by wireless telephone. Already heart-beats have been successfully transmitted to the U.S.A. A further use of the instrument is in the teaching of medical students. The heart-beats of the patient can be heard to any required " volume " in a lecture theatre, and records of peculiar conditions of the heart can be replayed to relays of pupils.

Honey Buzzards

In a recent letter to *The Times*, Mr. Anthony Buxton records some interesting observations on a nest of Honey Buzzards, made in the neighbourhood of Geneva. The prey of these birds, he says, " is wasps and hornets, and we reckoned that our pair and their twins accounted for at least 90,000 of those insects in their three months' stay. They time their nesting year by year with the nesting of the wasps, so that their young shall be hatched when the wasp grubs are the right size. The parents obviously find the nests by watching the flight of the queen wasps, marking them to ground, and then digging them up, just as a terrier digs up a rat." A curious supplement to this diet was the ripe red fruit of lords and ladies which was dropped into the nest for the young by the cock buzzard. It would be interesting to know whether, as the writer suggests, this was added as a protection against wasp sting.

Journey to the Moon

By Douglas McKie, Ph.D.

" The Man in the Moone," the fantasy of Bishop Godwin, is an early excursion into the realms of scientific fiction. The marvellous journey of Domingo Gonsales makes fascinating reading, with its ingenious form of aerial transport and its lunar " nature notes," and deserves to be better known.

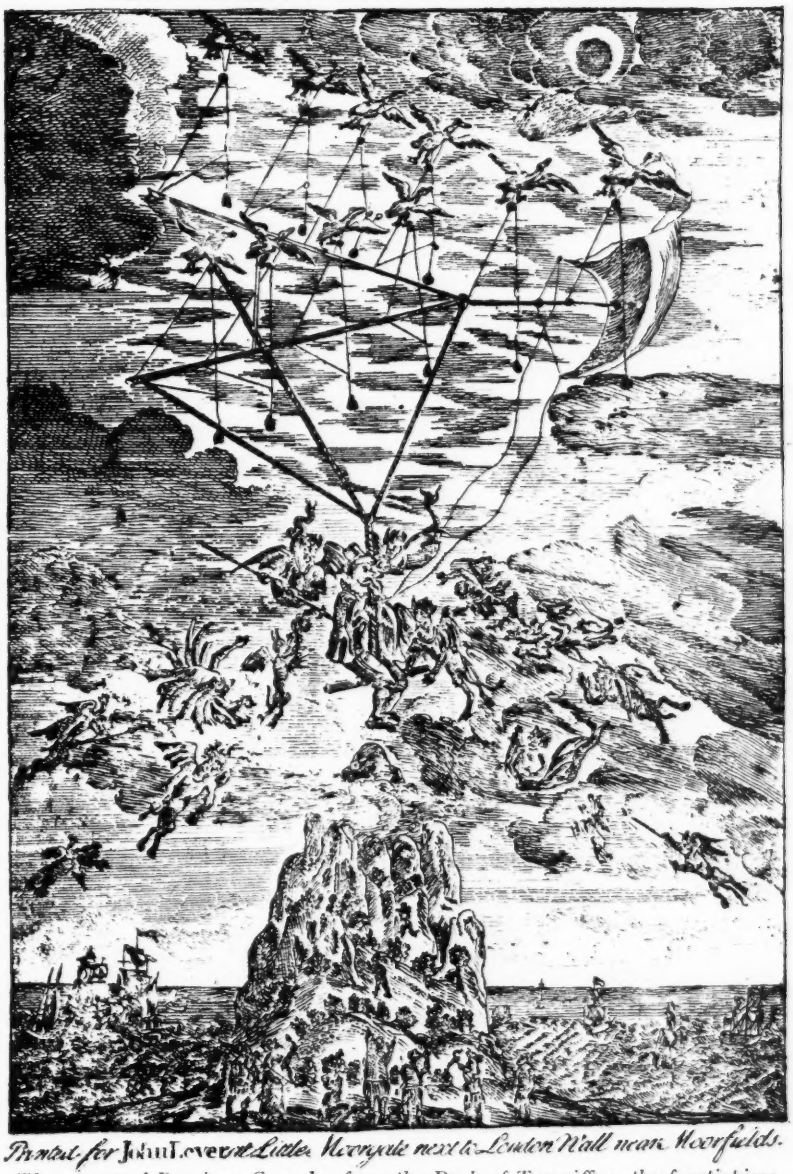
" It will be remembered—to use the usual substitute for, It has been forgotten," wrote Augustus de Morgan in his *Budget of Paradoxes* (London, 1872, p. 135), " that the posthumous work of Bishop Francis Godwin of Llandaff was published in 1638, the very year of Wilkins's first edition, in time for him to mention it at the end. Godwin makes Domingo Gonsales get to the moon in a chariot drawn by wild geese, and, as old books would say, discourses fully on that head. It is not a little amusing that Wilkins should have been seriously accused of plagiarising Godwin, Wilkins writing in earnest, or nearly so, and Godwin writing fiction. It may serve to show philosophers how very near pure speculation comes to fable. From the sublime to the ridiculous there is but a step: which is the sublime, and which the ridiculous, every one must settle for himself. With me, good fiction is the sublime, and bad speculation the ridiculous." On De Morgan's healthy scientific sentiments about good fiction and bad speculation, comment is unnecessary. Some account of Wilkins's project has already been given in DISCOVERY (1935, 16, 105-7): and it has recently been shown by McColley (*Annals of Science*, 1936, 1, 330) that there were two editions of Wilkins's *Discovery of a World in the Moone* published in the first year of its appearance, namely, in 1638, neither containing the famous Proposition XIV, the " Discourse concerning the possibility of a Passage thither," which first appeared in the third edition published in 1640. Godwin's book first appeared in 1638.

Episcopal Advancement

Francis Godwin was born in 1562 at Hannington in Northamptonshire, the son of the Rev. Thomas Godwin, afterwards Bishop of Bath and Wells. He entered Christ Church, Oxford, at the age of sixteen and graduated B.A. in 1580/1, B.D. in 1593/4 and D.D. in 1595/6: he was " accounted one of the most ingenious persons as well as assiduous students in the university." His advancement in the Church was steady: for his *Catalogue of the Bishops of England* (1601) Queen Elizabeth appointed him Bishop of Llandaff. In 1617 he was translated to the see of Hereford. He died in 1633 and was buried in the chancel at Whitbourne. He married when young a daughter of John Wolton, Bishop of Exeter, and had numerous children. Of him Wood said that he was " a good man, a grave divine, skilful mathematician, excellent philosopher, pure Latinist, and incomparable historian." Browne Willis says, however, that " notwithstanding the freedom he takes with other bishops' reputations, he was certainly a very great Symoniack, omitted no opportunity in disposing of his preferments, in order to provide for his children "—but these, as we have seen, were many. A portrait of Godwin, painted in 1613 at the age of 51, was engraved by Vertue in 1742 for Richardson's re-edition of Godwin's *Episcopi de Præsulibus Angliæ Commentarius, etc.* (Cantabrigiæ, 1743, 2 vols.).

A Magnificent Subtitle

Godwin's curious and fantastic work, *The Man in the Moone: or A Discourse of a Voyage thither*, was written when he was a student at Oxford, and so also was his *Nuncius Inanimatus*, in which he set forth a plan for passing messages in and out of beleaguered garrisons. *The Man in the Moone* appeared for the first time posthumously at London in 1638, and its title-page announced that it was written " by Domingo Gonsales." A second edition appeared in 1657, again at London; this was described as by " F.G., B. of H.", and it included the text and a translation of the *Nuncius Inanimatus*. A so-called " Second Edition" was published at London in 1768 with a very lengthy subtitle—" The Strange Voyage and Adventures of *Domingo Gonsales*, to the World in the Moon. Containing An Account of the Island of St. Hellena; the Place where he resided some Years in, and where he planned this Wonderful Voyage; his entering on Board one of the Homeward-bound *East-India* Ships for *Spain*; their running on the Rocks near the Pike of *Teneriff*, to avoid an *English* Squadron of Ships, that were in Pursuit of the *Spanish* Fleet; *Gonsales* had just Time to fix his Machine, which carried him in Safety to the Pike of *Teneriff*, having rested his Gansas on the Mountain, whence was pursued by the Savages; when giving the Signal to his Birds, they arose in the Air with him for their Journey to the Moon: The wonderful Apparitions and Devils he met with in his Progress; their Temptations to him, which he avoided, and their supplying him with choice Provisions; his leaving this Hellish Crew, and



The ascent of Domingo Gonsales from the Peak of Teneriffe; the frontispiece of the edition of 1768.

proceeding on his Voyage to the Moon; his safe Arrival there; Manners, Customs, and Language of the Emperors, Kings, Princes and People: His short Stay there, to the great Grief of the *Lunars*; the inestimable Presents in Jewels the Author received at his Departure; his repassing to our Earthly Globe again, and was set down in *China* by his Birds; his being taken for a Magician by the Country People, and preserved from their Fury by a *Chinese* Mandarin; his going aboard an *India* Ship bound for *Europe*; his safe Arrival in his own Country, where he made his Discoveries to the King of *Spain*, who held several Cabinet Councils to deliberate on a proper Use to be made of these Discoveries. With a Description of the Pike of *Teneriff*, as travelled up by some *English* Merchants." This delectable treasury of adventure, thus "puffed" in a way that is in no respect inferior in workmanship to the publisher's "blurb" and the film-producer's "trailer" of more recent days, was to be had "Price One Shilling" from the publisher, John Lever, "at *Little Moorgate*, next to *London Wall*, near *Moorfields*." If Lever's appendix of advertisements is any guide here, his methods probably paid him well. His other productions included a work on Captain Jones's travels in Patagonia "with a comical Description of Captain Jones's ruby Nose . . . his several desperate Duels . . . his Loves with the Queen of Noland . . ."; "Low Life . . . with an Address to Mr. Hogarth"; "The Secret History of Betty Ireland . . . full of surprizing Incidents in the gay Life she passed through . . . a proper Present to young People, to deter them from such Scenes of Life, that too many of the Young and Gay of both Sexes run into . . . with a beautiful Frontispiece of a Scene in gay Life"; "Tabes Dorsalis," a work on consumption, "embellished with a curious Frontispiece of a Gentleman and Lady in a deep Consumption . . . very proper for all Persons to read in these sickly Times"; "The Art of swimming" with provision against the cramp—"thousands of lives have been lost . . . which will now be saved by reading this excellent Book"; "The Husband forced to be jealous . . . the secret History of several noble Persons, translated from the French"; "Pteryplegia, or the Art of Shooting Flying" . . .

(" Be very careful to ask for Lever's Book . . . for fear of having the wrong Sort ") ; " Le Jardinier Solitaire . . . Also The Compleat Florist " ; a book on architecture ; " The pious Youths Recreation ; or Travels through Godliness " ; " Theophilus Cibber to David Garrick " ; " Sermons on eleven very important Subjects " ; a Latin Grammar ; " The Bloody Tribunal, or an Antidote against Popery " (a review of the Inquisition) ; and " A plain Address " to the Methodists. The learned Bishop Godwin had fallen into very mixed company by the year 1768.

Some Rare Translations

Apart from this curious re-issue, Godwin's book was reprinted in the Harleian Miscellany in 1746 and again in 1811. French versions, *L'Homme dans la Lune*, are mentioned of 1648, 1651, 1666, 1671 and 1731 : and German versions, *Der fliegende Wandersmann nach dem Mond*, of 1659 and 1660 are recorded. The present writer has been able to see several of these rare works, but it has not been possible to verify the existence of all the editions recorded. The frontispiece reproduced here is taken from the English edition of 1768 : the devils shown on it are an addition to the picture given in the original edition of 1638 : and there are no devils in the picture in the edition of 1657 or in the French edition of 1671 or in either of the two German versions of 1659 and 1660. Evidently, the English reader of fantasy in the 18th century had stronger pictorial tastes than his countrymen of the 17th century or their foreign contemporaries. The *Epistle to the Reader* describes the book as " an essay of Fancy, where Invention is shewed with Judgment " : and the book will always retain its interest, apart from its intrinsic merit as a work of fantasy, because of its undoubted influence on Wilkins, on Cyrano de Bergerac, and on Swift, to say nothing of the many others who have written on such a theme, Defoe, Poe, Jules Verne, Wells and their imitators.

In *The Man in the Moone*, the pseudonymous Domingo Gonsales begins by telling his readers that he was born in Seville, the son of noble parents and the youngest of seventeen children. He was intended for the Church, but went to the wars in the Low Countries, forsaking his studies in the University of Salamanca to serve under Alva without informing his parents. He sold his books and his bed and borrowed from his father's friends to equip himself with a horse for the journey. Robbed of his horse and his ducats by " the cursed *Gueses* " within a league of Antwerp, he had to begin his military career in a more lowly station than that which properly befitted his noble birth. However, as the ingenuous Gonsales himself might have said, merit, like murder, will out : soon he was promoted to a more honourable position and he found himself possessed, by booty and " other Accidents," of 3,000 crowns, which now easily opened the way for him to Alva's Court. Returning to Spain with Alva, who, it seems, not infrequently found the short stature of his escort a matter for some unrecorded or possibly unprintable jests, Gonsales was received by his parents with a joy that he ascribed, and possibly rightly, having regard to the circumstances of his departure, to the fact that " they found I had brought wherewith to maintain myself without being chargeable to them." His parents, fearing, not without good cause, that he would spend his gains as lightly as he had won them, succeeded in persuading him to marry the daughter of a wealthy merchant of Lisbon ; and thus he " lived like a Gentleman many years very happily," until in a quarrel he had the misfortune to kill a kinsman, " tho' a stout and proper Man ; but what I wanted in Strength I supplied in Courage, and my Agility countervailed for his Stature." In his forced flight he met with " a famous Spanish Count," of whom he reports that " it had been well if Vanity and Lying had been his only Crimes ; his Covetousness had like to have been my utter Ruin." To the Count, who was boasting of a recent but, as afterwards appeared, imaginary victory against the English on his way home from the West Indies, Gonsales confided the reason of his flight, whereupon the Count asserted that the victim was his kinsman too and demanded immediate recompense for his silence—covetousness, as Gonsales generously tells his readers, that might have proved utterly ruinous for him,

> " Though since it hath proved the Occasion for eternizing my Name I verily believe to all Posterity, and to the unspeakable Benefit of all Mortals for ever hereafter, at least if it please Heaven that I return home safe to my Country, and give perfect Instructions how those almost incredible and impossible Acquirements may be imparted to the World. You shall then see Men flying in the Air, from one Place to another, you shall then be able to send Messages many hundred Miles in an Instant, and receive Answers immediately, without the Help of any Creature upon Earth ; you shall then presently impart your Mind to your Friend, though in the most remote and obscure Place of a populous City, and a Multitude of other notable Experiments ; but what exceeds all, you shall then have the Discovery of a *New World*, and Abundance of rare and incredible Secrets of Nature, which the Philosophers of former Ages never so much as dreamt of ; but I must be cautious in publishing these wonderful Mysteries, till our statesmen have considered how they may consist with the Policy and good Government of our Country, and whether the Fathers of the Church may not judge the divulging them prejudicial to the Catholic Faith, which (by those Wonders I have seen above any mortal Man before me) I am instructed to advance without Respect to any temporal Advantage whatsoever."

In brief Gonsales refused to pay the hush-money and took ship in the opposite direction, sailing on a trading voyage to the East Indies, where he bought very cheaply many diamonds, emeralds and pearls, intending to reap a handsome profit by their sale on his return to Spain : " but having doubled *Cap Bona Esperanza* in

my Way home, I fell dangerously sick, expecting nothing but Death, which had undoubtedly happened, but that we just then recovered the blessed Isle of St. *Hellens*, the only Paradise I believe on Earth, for Healthfulness of Air, and Fruitfulness of Soil, producing all Necessaries for the Life of Man." Here he was set ashore, his only companion being "*Diego*, my Black moor," and here he recovered his health, solacing himself with the company of birds and beasts, among them noticing "a kind of wild Swans (whereof I shall have Occasion to speak more hereafter) who like our Cuckows and Nightingales, go away at a certain Season, and are no more seen that Year." To provide sufficient food by hunting and fowling, Gonsales and Diego lived at opposite ends of the island, communicating by signals made with a white cloth or smoke or dust or "other refined Ways" by day and a light at night. These methods he improved upon by "winged Messengers," training some young wild swans to come to his call or by "shewing them a white Cloth."

> "'Tis wonderful," he says, "to think that Tricks I taught them ere they were a Quarter old, amongst others I used them by Degrees to fly with Burdens, wherein I found them able beyond Belief, and a white Sheet being displayed to them by *Diego*, upon the Side of a Hill, they would carry from me to him Bread, Flesh, or whatever I pleased, and upon the like Call come to me again."

Training the Wild Swans

In invention and in fantasy and indeed in all things, it is only the first step that counts, and the rest was easy: the wild swans or gansas were suitably harnessed in a team and their combined powers proved sufficient for transporting gradually increased burdens until they succeeded in carrying a lamb, "whose Happiness," says Gonsales, "I much envied, that he should be the first living Creature to partake of such an excellent Device." And now, since it seemed possible that they might carry a man, Gonsales prepared for the venture:

> "Having prepared all Necessaries, I one Time placed myself and all my Utensils on the Top of a Rock at the River's Mouth, and putting myself upon my Engine at full Sea, I caused *Diego* to advance the Signal, whereupon my Birds, twenty-five in Number, rose all at once, and carried me over lustily to the Rock on the other Side, being about a Quarter of a League; I chose this Time and Place, because if any Thing had fallen out contrary to Expectation, the worst that could happen was only falling into the Water, and being able to swim well, I hoped to receive little Hurt in my Fall. When I was once safe over, O how did my Heart even swell with Joy and Admiration at my own Invention; how often did I wish myself in the Midst of *Spain*, that I might fill the World with the Fame of my Glory and Renown? Every Hour I had a longing Desire for the coming of the *Indian* Fleet to take me home with them, which then staid three Months beyond their usual Time."

The fleet at last arrived and Gonsales, swearing the Admiral to secrecy, was taken aboard and sailed for Spain. Nearing Teneriffe, however, the Spaniards met with the English Fleet and were promptly engaged: the Spanish commander ordered his ships to disperse and attempt escape, and the captain of the ship in which Gonsales had sailed decided to run ashore, a plan with which Gonsales heartily disagreed. However, as the ship struck, he had his birds ready and at a signal they carried him safely to land; here almost at once he was attacked by a crowd of savages, had to rise with his gansas once more and was carried to the top of the "Pike of Teneriff." This to his amazement proved a merely momentary halt; for it was the season of their migration, and

> "They with one Consent rose up, and having no other higher Place to make toward, to my unspeakable Fear and Amazement, struck bolt upright, and never left towring upward, still higher and higher, for the Space, as I guest, of an Hour, after which I thought they laboured less than before, till at length, ah wonderful! They remained immoveable, as steadily as if they had sat upon so many Perches; the Lines slacked, neither I, nor the Engine moved at all, but continued still, as having no Manner of Weight. I found then by Experience, what no Philosopher ever dreamt of, namely, that those Things we call heavy do not fall towards the Center of the Earth as their natural Place, but are drawn by a secret Property of the Globe of the Earth, or rather something within it, as the Loadstone draweth Iron, which is within the Compass of its attractive Beams. For though my *Gansas* could continue unmoved, without being sustained by any Thing but the Air, as easily and quietly as a Fish in the Water, yet if they forced themselves never so little, it is impossible to imagine with what Swiftness they were carried, either Upward, Downward, or Sideways; I must ingenuously confess my Horror and Amazement in this Place was such, that had I not been armed with a true *Spanish* Resolution, I should certainly have died for Fear."

Polyglot Devils

It now became clear to Gonsales that his gansas were directing their course to the Moon; they moved very swiftly, and, he says:

> "Devils and wicked Spirits . . . came about me in great Numbers in the Likeness of Men and Women, wondering at me like so many Birds about an Owl, and speaking several Languages which I understood not, till at last I met with some that spoke good *Spanish*, some *Dutch*, and others *Italian*, all which I understood . . . I was much obliged to those, whether Men or Devils I know not, who . . . told me, 'If I would follow their Directions, I should not only be carried safe Home, but be assured to command at all Times all the Pleasures of that Place.' To which Motion, not daring to give a flat Denial, I desired Time to consider, and withal indebted them . . . to help me to some Victuals . . . they readily brought me very good Flesh and Fish . . . Wines likewise I tasted of divers Kinds as good as any in *Spain*, and Beer no better in all *Antwerp*. They advised me . . . they would find Means to carry me back, and set me safe in *Spain* . . . provided I would become one of their Fraternity, and enter into such Covenants as they had made to their Captain and Master, whom they would not name: I answered civilly, 'I saw little Reason to rejoice in such an Offer, desiring them to be mindful of me as Occasion served'; so for that Time I was rid of them; having first furnished my Pockets with as much Victuals as I could thrust in, among which I would be sure to find a Place for a small Bottle of good Canary."

The clouds were now between Gonsales and the Earth; the stars could be seen "like the Moon with us in the Day-Time"; the Moon appeared "of an huge and dreadful Greatness"; the gansas were making fifty leagues an hour; the Earth decreased in size and

shone like the Moon ; its Continents could be discerned and their apparent motion eastwards indicated the correctness of the belief of some philosophers in the Earth's rotation, which, as Gonsales watched it leisurely from his " engine," appeared to be complete in twenty-four hours, whereby he was able to reckon days and time ; a swarm of locusts went by like a red cloud, evidently on their passage from the Moon to the Earth ; and presently the lands and waters of the Moon became visible. Soon the gansas came to rest on the top of a high hill in the Moon. Here he at once observed that all things were much larger than on earth : animal life was totally different, except for the presence of migrants such as swallows, nightingales, cuckoos and his own gansas, " all of which, as I now perceived, spend their Time in their Absence from us, in that World." Gonsales felt too an extreme hunger on landing and, turning to the victuals provided by the " cursed Spirits," found that they had all changed into other substances either inedible or disgusting ; but he saw his gansas eating greedily of the leaves of a shrub and he followed their example with delight and satisfaction. A strange kind of people now appeared, strange in features, manner and apparel and twice as tall as those on Earth ; in his surprise, he says : " I crossed myself, and cried out, *Jesu Maria* : No sooner was the Word *Jesu* pronounced, but Young and Old fell all on their Knees (whereat I not a little rejoiced) " -- and thus did Gonsales, unlike the theologians of his time, drive straight through the difficulties involved in a plurality of worlds and a plurality of redemptions. He was taken before the ruler of that part of the Moon in which he had landed and he was well received. The lunars or moon-men, he says, lived much longer than earth-men ; they were of various heights, and only the tallest could remain awake at full moon, during which period those of lesser stature went into a long sleep, a process to which he, as a man of short stature, also found himself subject. He gained some knowledge of the language, carefully attended to the health of his gansas and presently was allowed to converse through a window, although not face to face, with the King of the Lunars. The moon-men, he found, never abused him with any lie ; among them there was neither crime nor vice, but equally there was no want of food or other necessaries ; " their females are all absolute Beauties, and by a Secret Disposition of Nature, a Man there having once known a Woman never desires any other " ; peace and amity prevailed everywhere, and the moon was "another Paradise"; if any were born suspect as " like to be of a wicked and debauched Humour, they send them . . . into the arth," and, he adds :

> " Their ordinary Vent for them is a certain high Hill in the North of *America*, whose People, I am apt to believe, are wholly descended from them, both in regard of their Colour, and their continual use of Tobacco, which the *Lunars* or *Moon Men* smoak exceedingly. . . . Sometimes, though but seldom, they mistake their Aim, and fall upon *Europe*, *Asia*, or *Africa*."

There were neither lawyers nor physicians in the Moon : both were unnecessary. Death was a pleasant departure and bodies were not corrupted. Life expired as a candle ceases to give light when what nourishes it has been consumed. At the approach of death a lunar prepared a great feast for his relatives and friends ; and all made merry and rejoiced, whereas, says Gonsales : " With us in the like Case all seem to mourn, when many of them do oft but laugh in their Sleeves, or under a Vizard." In the Moon there was no rain, wind or change of weather : spring was perpetual. But Gonsales was anxious to return ; he asked leave to depart, but found difficulty in getting away : the Prince

> " dissuaded me, insisting on the Danger of the Voyage, the Misery of that Place from whence I came, and the abundant Happiness I now enjoyed ; but the Remembrance of my Wife and Children, outweighed all these Reasons, and to say the Truth, I was so elated with a Desire of the Glory I should purchase at my Return, as methought I deserved not the name of a *Spaniard*, if I would not hazard twenty Lives rather than lose the least Particle thereof. I replied, I had so strong a Desire to see my Children, that I could not possibly live any longer without going to them."

The Happy Return

At last, seated in his engine, he gave his gansas the signal and began the return to Earth ; the voyage proceeded safely and he arrived in China, where he was captured, taken before a mandarin near Pekin and charged with being a magician. The mandarin took him under his protection—but this time Gonsales had irrecoverably lost his gansas ; he was honourably treated, though held under some restraint, but presently he was taken to Pekin and allowed to meet the Jesuit fathers, at whose advice he wrote this account of his journey to the Moon to be sent to Spain before his arrival. And he closes his fantastic tale by telling his readers of his hopes of a speedy return to his native land :

> " I came often to the Fathers, with whom I consulted about many Secrets, and with them also laid the Foundations of my Return, the blessed Hour whereof I do with Patience expect, that by enriching my Country with the Knowledge of these hidden Mysteries, I may at last reap the Glory of my fortunate Misfortunes."

Bishop Godwin easily survives De Morgan's test of good fiction being the sublime and bad speculation the ridiculous : he belongs to the goodly company of the tellers of great tales.

A system of phonetic shorthand that should be useful for taking lecture notes, and for other purposes where time and space have to be saved, is *Abbrevia*. The essence of the system is that only ordinary letters and punctuation marks are employed, thus enabling the typewriter to come into play. Full particulars are included in a manual obtainable on application at the office of DISCOVERY.

Book Reviews

The Administration of Archives

A Manual of Archive Administration. By HILARY JENKINSON. New and Revised Edition. (Lund, Humphries. 12*s.* 6*d.*)

It is a good sign that a new edition has been called for of the Manual which Mr. Jenkinson first published fifteen years ago; nor is it surprising that, while he has found nothing to change in principle, he has found much to add in detail. Archive administration, which formerly was confined to a few great institutions which did not need a manual, and to a number of ancient repositories which did not know that they needed one, has become a matter of wide and general interest since the Act of 1924, which abolished copyholds and placed manorial court-rolls under the superintendence of the Master of the Rolls. It should always be remembered to the credit of Lord Hanworth that he seized the opportunity thus offered, and with the co-operation of local authorities and institutions converted into a reality that which to the Royal Commission on Public Records before the war was only a hope and an aspiration, namely, the creation of a number of local repositories where archives of all descriptions, ecclesiastical as well as civil, can be deposited (not necessarily with any change of ownership) with the certainty that they will be well cared for and placed at the service of students. The creation of the British Records Association is another sign of interest in the subject, as well as a valuable organ for the promotion of archive science.

It is for the officers of these new repositories that Mr. Jenkinson's manual will be especially useful; and if a criticism is to be offered on it, it is that he has had too exclusively in view the practice of the Public Record Office, with which (though the fact is omitted from the qualifications stated on his title-page) Mr. Jenkinson has been so long and so honourably connected. Some curators may be appalled by the mass and complexity of details offered for their study, and may not realise that something simpler would serve their turn. They may be assured that all the information and all the advice is good, but that much may be differently adapted to meet the requirements of different circumstances.

Mr. Jenkinson devotes considerable space to the definition of an archive. Broadly speaking, they are documents brought into existence in the course of the administration of an institution whether public or private; and as objects attached to a document become part of the archive, Mr. Jenkinson speculates whether an elephant sent home by a colonial governor with a covering despatch should not be claimed as an archive. In this country a further important qualification has been that the document should never have been out of the custody of the institution to which it belongs. The great distinction between the Public Record Office and the Manuscript Department of the British Museum used to be, and in the main still is, that the documents in the former have never been out of official custody, while those in the latter have been. There may have been a little weakening in the practice of the P.R.O. (see pp. 42, 43), but the distinction is a practical and important one, in deciding the proper destination of documents which may be seeking a permanent home.

For the guidance of the custodians of local repositories, however, it is of less importance. They will have to deal with many documents which have for a time been out of official custody, and with many (*e.g.*, parish registers) which, though technically in official custody, cannot be said to have been free from the risks of mishandling which official custody is supposed to avert. Sometimes, moreover, the custody may continue the same, but may cease to be official, as when a firm of solicitors retains the records of an extinct public body. But whether the documents are technically "archives" or not, the rules for their care and custody remain much the same; and Mr. Jenkinson's Manual (which includes advice on arrangement, packing, storing and repairing, as well as on the registering and organising of archives) can be cordially recommended to all who are responsible for the manufacture, preservation, and administration of collections of documents. The discussion is sometimes verbose, but the practical suggestions will often be found less formidable in practice than they appear in reading them.

One of the most formidable problems confronting the archivist of the future is the mass of records with which he has to deal. Mr. Jenkinson deals with this question at considerable length, but does not go far towards solving it. When once a document has become an archive, there is no one whom he would trust to destroy it. The only hope is in a drastic weeding before it has become an archive; and this duty is apparently to be entrusted to the official in charge of the Registry. There seems to be no security between the official who will destroy everything as soon as it ceases to be needed for current use, and the official who will be afraid to destroy anything. If we try to keep everything which *may* be of use to somebody, the researcher of the future will be unable to move for the mass of his materials.

FREDERIC G. KENYON

Two Books of the Islands

The Peat Fire Flame. By A. A. MacGregor. (Moray Press. 12*s.* 6*d.*)

Island Memories. By J. W. Dougal (Moray Press. 5*s.*)

Mr. MacGregor disarms the reviewer by hastening to admit, in the preface of his book, that he is "well aware that this work may lay itself open to the criticism that much of the material is too compendious, and detached." The word "compendious" does perhaps sum up as well as any other this varied collection of Highland anecdotes, and legends. The book is indeed a compendium rather than a story-book. Those who come to it hoping for tales of Faery, or Heroics, as they are told around the peat fire at a winter night *ceilidh*, may go away in the main disappointed; for it is seldom that the compiler allows himself to drop into the homely picturesque language of the story-teller; but any who wish to learn the facts (or should one say the fantasies?) out of which such stories are made, will find here a mine of information, arranged, for his assistance, under appropriate headings: The Brownie; The Waterhorse and kindred monsters; Folk tales of the '15 and the '45; etc.

Under this last heading Mr. MacGregor makes an astonishing statement: "It may be said without fear of serious contradiction that the risings of 1715 and 1745 . . . constitute the only outstanding phase of Scottish history since the arrival of Columba, or of Ninian." Does Mr. MacGregor mean that the romance and popular legend which have accumulated about these incidents have given them a place in the story of Scotland far outweighing their real significance, or does he mean that such a statement can hardly expect a "serious" contradiction? The illustrations, mostly photographs taken by the author himself, add greatly to the interest of the book.

Island Memories, by the late John Wilson Dougal, has also the tang of the peat reek. For it, too, tells of the legends and dream-world of the islander, though from a somewhat different point of view. Where Mr. Dougal recounts a ghost story, he has generally an explanation to give of the ghost (as, for instance, the bearded face which shone out of the darkness at the haunted Tower of Dune!).

Mr. Dougal was, we are told by Mr. MacGregor, who edits this posthumous book, an analytical chemist by profession and a geologist at heart. It was in pursuit of his heart's desire, therefore, that he spent his holidays on the outer Hebrides, where his discovery and tracing of the flint crush belt that runs throughout the length of the Long Island earned him the degree of Ph.D. of Edinburgh University. This book, however, is not a work on geology, it is what it names itself, a record of pleasant memories, of holidays spent among the wild and beautiful Western Isles, amidst moorland and hill country and the ever-present influence of the sea. Incidentally it reveals a shrewd and kindly personality. Mr. Dougal evidently won the hearts of the islanders, and he has many tales to tell of life in the shielings, and in—

> "The croft by the seas
> That resound on the Hebrides,
> On the edge of the world!"

Had he lived to revise his book himself he would probably have added to some of his memories and rounded off others; but to all who love quiet places and kindly humour, with a sufficiency of learning to give it a tang, this little book can be heartily recommended.

H. M. Anderson.

Birds in General

The Ways of Birds. By Thora Stowell. (Country Life, 5*s.*)

This book, which is one of the "Design of Life Series," published by "Country Life," contains much useful information imparted in simple language. There are diagrams illustrating a typical bird skeleton, and the feathers, claws and beaks of various species. The author's advice to the embryo bird observer, "to try to forget what other people have said and look at birds for yourself, noting everything you have observed," could not be bettered. Field glasses and a good handbook with coloured illustrations, she rightly says, are essential, and her suggestion that observations might be concentrated on the common birds that live near our own homes is practical and sensible.

She is sound on the important question of protection and sees that it is for the coming generation to decide whether some of our rarest birds will be lost to us for ever. I reluctantly agree with her that human beings are the worst enemies of birds; certainly this is true of collectors and many gamekeepers, market gardeners and farmers, though some are less ruthless.

Many amateur bird-watchers are unaware of the high temperature of birds: the author reminds us that a sparrow's temperature is usually 110° Fahr. (a swift's is 111.2° and a heron's 105.8°). It is this, coupled with their rapid breathing and quick pulse, that makes their span of life so short. They live their lives intensely.

The known facts as to the physical characteristics of birds, the structure of their feathers, their digestion systems, their coloration, their songs and call-notes, their nests and the problems of migration, are generally presented in a concise and readable form. It is important to remember, as Miss Stowell points out, that, passing through the lower scales of life, it is in birds that we first find "glimmerings of true affection that. . . comes to its highest form in the human race."

There are also good chapters on penguins (the derivation of the name from the Welsh "pen gwyn," meaning white head, is very doubtful) and other flightless birds. It is sad to realise that many of these are in danger of extinction. The author has first hand knowledge of ostrich farms and tells us much of interest about their courtship, incubation and communal nesting; a nest may contain 30 eggs. The proverbial stomach is not always proof against the effects of broken glass, but she knows a pet ostrich called "The Living Money Box" from his predilection for a diet of shining coins; copper pence he contemptuously rejects.

Unfortunately it is necessary to point out that the book contains inaccuracies; the author is too prone to state as fact what has never been proved scientifically. Buzzards are not now "rare in England": within the last few days eleven were seen in an hour in one district; they are not confined to Devon, Wales and Scotland, and on the east coast of England they are only casual migrants. Martins are not the first English spring migrants: wheatears, and often chit-chafts, are earlier. That there is "evidently" some wireless communication between migrating birds is merely supposition. The late T. A. Coward's belief that the nightjar produces the "whipcrack" sound by a swift downward stroke of the wings rather than by striking them together upwards cannot be said to have been "proved" correct. Opinions differ and are likely to do so.

Whether in most cases birds do not seek the fruit but the insects with which it is infected is at present being tested by an inquiry organised by the British Trust for Ornithology. In the meantime blackbirds consume perfectly sound cherries in my garden. Ravens in England are more common on cliffs than on

mountains and are beginning again to nest in trees. The author states that she knows a case of swallows walling up alive sparrows which had robbed them of their nest; in the absence of exact evidence by a credible observer belief in the accuracy of the observation is difficult. It is an old story, but proof is lacking.

The book is illustrated by excellent photographs.

E. W. HENDY.

Termite Ethics

Man and the Termite. By HERBERT NOYES. (Peter Davies, 8*s.* 6*d.*)

It is curious that within a few weeks there should appear two popular books on termites in English, neither by entomologists, both based on field observation. The author of this one has spent many years in the tropics and has an observant and enquiring eye. He gives us in attractive form a number of observations of great interest, and his book should do much to attract the attention of others who have opportunities of studying these extraordinary insects.

But it is a pity that he did not confine himself to the description of what he has seen, and it would have been a better book if he had left his archæological and philosophical disquisitions to someone who understands the subject, for his knowledge of entomology, geology and archæology is vague and cloudy. He has read a good deal, but failed to digest his reading. His perpetual wail against the failure of our civilisation runs through the book until the reader is wearied, and the irony is often forced and in questionable taste. He may humanise his termites attractively for instructional purposes, but why judge termite ethics by human standards?

Does Mr. Boyes really think that Man of the Magdalenian, Aurignacian, Solutrean, Capsian and Azilian cultures was some species other than *Homo sapiens*, or that "little is known outside Europe of prehistoric Man?" Why cannot it be conclusively proved that the termite antedated the earliest form of Man? What does he mean by "prediluvian days," when writing of Tertiary time? And on what evidence does he suggest the following gem, that it may be reasonably supposed that Europe was overrun by termites when "the last Ice Age receded at the beginning of the Pleistocene?" We can, however, agree with him that it is "reasonable to suppose that the Capsian and other Neolithic communities of Northern Africa and Lower Egypt were acquainted with them (*i.e.*, termites), if only in their primitive form." On the practical side, although he quotes the Californian Termite Report, he has overlooked two important points brought forward in it. One, the part played by termites in weakening structural timbers in earthquake countries, and the definite statement that modern methods will greatly reduce and even ultimately render insignificant the loss due to termite attack.

There are plenty of avoidable errors. *E. tirucalli* is consistently misspelt. Both references to Herodotus are inaccurate. Giant dragonflies did not fly in the Lower Oolite and the Hymenoptera did not exist much earlier. Termites are not unique in the insect world in their deciduous wings. The Silurian is dated at 300,000,000 years ago on page 1, but 200,000,000 on page 164. And how can a Miocene fossil be the precursor of a more ancient type? But in spite of these blemishes, the book is worth buying for the sake of the fresh and agreeable account of the field observations, and the photographs are good; those of the "doomed area" in Central Australia and of the colony of an unidentified species in Northern Rhodesia are impressive, the latter recalling the colonies of the mushroom-shaped towers of Angolia.

MALCOLM BURR.

Psychology of Colour

Colour Harmony, its Theory and Practice. By A. B. ALLEN (Warne. 3*s.* 6*d.*)

This little book is written from the standpoint of the teacher in a children's school—not an Art School. It has thus, of necessity, to be simple. But Colour Harmony is an extremely subtle and difficult subject—as much so as harmony in music; and to attempt to condense not only Colour Harmony, but the physiology of colour-vision, and the psychology (a large field in itself) of colour—with some rainbow-myths and a biography of Ostwald thrown in—into a work of 128 pages, was a superhuman feat.

To review the book is almost as difficult; there is so much that is excellent, yet much that is highly debatable. Mr. Allen founds his system on Ostwald's—who got his "opposite colours" wrong: the complementary of spectral red is not sea-green, but a very green (peacock) blue—and that of mid-yellow is violet-blue. This can be easily tested by observing "after-images, and will be found correct by anyone not suffering from the yellowing effects of lenticular pigmentation. Such errors are probably the reason why so many colour-harmonists—including Ostwald and Mr. Allen—find that two complementaries combine harmoniously. The reviewer thinks that far better harmonies can be found between two hues, the ratio of whose wave-lengths is very near that of a musical "third"—*i.e.*, 4/5. Red and leaf-green, orange and peacock-blue, jade-green and violet, are three such pairs—and form each a sweet but piquant concord—as does a "third" in music.

Mr. Allen, very commendably, insists on the standardisation of colour; the necessity for this is becoming recognised, and there are now standard names, or numbers, for hues of certain wave-lengths in the dyeing and in the horticultural trades, also in other well-known systems besides Ostwald's, such as the American "Munsell" colour-system. (Which is all rather as though every orchestra in the country had its own musical notation, rendering the scores of each unreadable by any other.)

This is an interesting and stimulating little book, and has the two great virtues of clarity and terseness. Two of the best chapters are that on Home Decoration and the strikingly original one on Weaving The print is excellent, and the colour reproduction really beautiful.

MARY BARNE.

The Teaching of Art, to Infants and Junior Children. By A. B. ALLEN. (Warne. 4*s.* 6*d.*)

Romance of the Alphabet. By A. B. Allen. (Warne. 3*s.* 6*d.*)

To encourage young children to "express their impressions" is—writes Mr. Allen—known as "The New Art." But he wisely deprecates the use of this grandiose name (which must evoke shudders in all old enough to remember "l'Art Nouveau" of the nineteen-hundreds). Give the children lots of paint, hog-hair brushes (ill-afforded by the struggling adult painter), occasionally pastels, and "a good time is had by all." Still, it must strike the cold-blooded casual reader that a little more guidance and correction might be no bad thing. For instance, when drawing with the brush direct (excellent training), the natural propensity—strong both in children and adults—to draw in outline might be checked; it would be overcome in time, and they would learn to see things structurally The book has many practical hints, useful to the teacher. The general reader will enjoy the clever children's drawings, excellently colour-printed.

Mr. Allen's other little volume, containing much curious lore, gives the origins—mostly Egyptian—of each letter of the alphabet. It incorporates a history of alphabets in general, showing how picture developed into symbol, and symbol into letter; also ancient history, myth, and legend, having little, if any, connection with alphabets—besides much that has; the latter includes, in an Appendix, interesting accounts of the discoveries of such things as the Rosetta Stone and the Rock of Behistun.

Westward Bound in the Schooner "Yankee." By Captain and Mrs. IRVING JOHNSON. (Robert Hale. 15*s*.)

How many people will steer clear of this book, thinking it just another "going places" travelogue of the usual depressing sort? Not many, it is to be hoped, for it is one of the outstanding travel books of the year. It is simply the day-to-day tale of an eighteen-months' trip round the world, keeping just south of the Equator. New islands were visited and mapped, and the usual places (not forgetting Bali) were inspected. What makes it an unusual book is that the story is told (mainly by the skipper's wife) in a really simple and straightforward style. Mrs. Johnson says little about herself, indulges in no purple passages, and without the conscious effort of the *raconteur* she manages to introduce many good stories and telling anecdotes. A delightful piece is the pidgin English proclamation read in Rabaul after the War, ending "No more 'um Kaiser, God Save 'um King."

It must have taken great personal qualities in each of the amateur crew of the *Yankee* for them to stick together for a year and a half, and the whole book stamps them as an unusually pleasant crowd of globe-trotters, quite apart from the too common type which accomplishes the trip in an atmosphere of rudeness and writes its book largely in the first person. This book has the leisurely style of English prose, without the heaviness often found in home production, and is leavened here and there with true American humour. Speaking of the way in which the tower-bearers at a Bali funeral dash to and fro to evade the evil spirits which follow the body, the author writes: "Apparently the devils had a long wheelbase and could not make the sharp corners the way the towers did."

The only adverse criticism is that the personalities on the boat are too mixed up. Doubtless modesty on their part was responsible, but having with some trouble identified in the photographs Exy, Mofe, Brick and Dottie, one would have wished to hear more about Doug, Ted, Betty, Bob and the others. The photographs are very numerous and very good, and combined with the text make a book which could serve as a model for all round-the-world travellers.

The Face of Ireland. By MICHAEL FLOYD. (Batsford, 7*s*. 6*d*.)

Excluding the guide-book proper, we have here, perhaps for the first time, a book dealing with Ireland as a whole from the purely topographical point of view. It would be difficult to write a really bad book about the scenery of Ireland, whose variety of fascination would sharpen the dullest pen. But Mr. Floyd knows and loves his Ireland, and has written a really good book, one which gives the reader, if he has not yet visited Ireland, a clear idea of what he will see. There is no attempt to veil the unattractive side—the tragedy of the splendid houses that have become Dublin slums; the featureless drabness of some of the small county towns (but not all); the monotony of the infertile limestone flats of the west-centre. But for the credit side our author has a keen eye; the first-class beauties of Ireland are so numerous that the superficial observer may be almost dazzled. Not so Mr. Floyd; he can spare time to notice that the later 19th century was *not* an era of degraded building in rural Ireland; he can halt his car to admire the humours of a country cattle fair; and he can show you where best to appreciate the green mosaic of the lowlands that are the true heart of Irish life. For a self-confessed view-lover like Mr. Floyd the topography of Ireland is inexhaustible and his book leaves the reader with the pleasant feeling that the author's mind contains enough material for another as long and as interesting. It is a book which should swell still further the tide of visitors to Ireland; and even the most hurried may take comfort from the fact that no amount of tourists can spoil the wild charm even of Killarney—a true and surprising fact that has not escaped the eagle eye of Mr. Floyd.

Books Received

Giant Fishes, Whales and Dolphins. By J. R. N. NORMAN and F. C. FRASER. (Putnam, 15*s*.)
African Odyssey. By W. R. FORAN. (Hutchinson, 18*s*.)
Plant Hunter's Paradise. By F. KINGDON WARD. (Cape, 12*s*. 6*d*.)
Wanderings of a Bird-Lover in Africa. By MADELINE ALSTON. (Witherby, 8*s*. 6*d*.)
The Mountain Scene. By F. S. SMYTHE. (Black, 12*s*. 6*d*.)
Watching Wild Life. By PHYLLIS BOND. (Longmans, 6*s*.)
Swift Movement in the Trees. By PHYLLIS KELWAY. (Longmans, 6*s*.)
The Bird-Lovers' Book of Verse. Collected by CHRISTINA CHAPIN. (Witherby, 6*s*.)
Out of My Life and Work. By AUGUSTE FOREL. (Allen & Unwin, 15*s*.)
Human Affairs. Edited by R. B. CATTELL, J. COHEN, and R. M. W. TRAVERS. (Macmillan, 10*s*. 6*d*.)
Towards the Twentieth Century. By H. V. ROUTH. (Cambridge Univ. Press, 21*s*.)
The World of Man: First Studies from Great Britain. By C. C. CARTER and C. A. SIMPSON. (Christophers, 2*s*. 9*d*.)
The Psychologist at Work. By M. R. HARROWER. (Kegan Paul, 5*s*.)
Love and Thought in Animals and Men. By SERGE VORONOFF. (Methuen, 6*s*.)
Yoga. By K. T. BEHANAN. (Secker & Warburg, 10*s*. 6*d*.)
Weather Rambles. By W. J. HUMPHREYS. (Bailliere, Tindall & Cox, 11*s*. 6*d*.)
Coloured Light. By A. B. KLEIN. (Technical Press, 30*s*.)
Sound Recording for Films. By W. F. ELLIOTT. (Pitman, 10*s*. 6*d*.)
A Hundred Years of Chemistry. By ALEXANDER FINDLAY. (Duckworth, 15*s*.)
Lange's Handbook of Chemistry. (2nd Edition.) (Handbook Publishers Inc., Ohio, $6.)
Evolution and its Modern Critics. By A. M. DAVIES. (Murby, 7*s*. 6*d*.)
Frontiers of Science. By C. T. CHASE. (English Universities Press, 12*s*. 6*d*.)
Plants and Animals. By M. A. GRIGG. (Cambridge Univ. Press, 2*s*. 6*d*.)
The Microscope. By JOHN R. UPTON. (Murray, no price stated.)
Amateur Power Working Tools. By A. F. COLLINS. (Lippincott, 7*s*. 6*d*.)
Preparation of Mirrors for Astronomical Telescopes. By GEORGE McHARDIE. (Blackie, 3*s*. 6*d*.)
The Design and Construction of Flying Model Aircraft. By D. A. RUSSELL. (Harborough Publishing Co., no price stated.)
Television Engineering. By J. C. WILSON. (Pitman, 30*s*.)
Journey to Turkistan. By Sir ERIC TEICHMANN. (Hodder and Stoughton, 15*s*.)
Sterols and Related Compounds. By Prof. E. FRIEDMANN. (Heffer, 7*s*. 6*d*.)
Forbidden Journey. By ELLA K. MAILLART. (Heinemann, 12*s*. 6*d*.)